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CIVIL ENGINEERING.

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Rough Notes of an Exploration for an Inter-oceanic Canal Route by way of the Rivers Atrato and San Juan, in New Granada, South America.

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Errata.—On page 81, line 10, for Plate III, read Plate IV.

Continued from page 84.

Next morning we sat off before sunrise, our host having informed us that by so doing we should reach San Pablo late on the same afternoon, *before the rain should begin.* He was desirous that we should accept a present of cacao nuts, of his own raising, for preparing chocolate on our way; but as we had determined to press on all day without stopping to cook, we declined his offer. He would not, however, let us off before taking a cup of chocolate with him. The women had even risen long before day to prepare breakfast for us; but as habit had rendered it impossible to eat at so early an hour, we were compelled to resist their kind solicitations to partake of it. It required many protestations on our part to allay the feeling of mortification to which our refusal evidently gave rise. We were, however, most efficiently sustained by our patron, who not only assured them that we eat almost nothing, but exhibited a praiseworthy zeal in atoning for our short comings, by swallowing, at intervals between his sentences, plantains, boiled peccary, parrot, and monkey, sufficient for the whole party.* We had arranged with our sable friend to take

* Trifling incidents of this kind are mentioned, not with a view of imparting a character of personality to my narrative, but merely as confirmatory of my previously expressed experience of the hospitable disposition of the inhabitants of this region, when properly approached.

care that our boat should be safely delivered to Señor Posso, at Baudó; he having, on his part, undertaken to return her to her owner.

As our bogas had left us the day before, to have a canoe in readiness for us on the Surúcco, we engaged two or three of our host's retainers to carry our baggage across the atravesia, or pathway over the ridge.

This we found to be about three miles in length, as nearly as we could judge by the time required to walk it; namely, an hour and a half, at a very slow rate, the way being muddy, and the air extremely close and sultry.

My previous observations at the mouth of the Baudó, and along the Pepé, having fully convinced me of the futility of any canal scheme by this route, I did not consider myself at liberty to consume time in making any *exact* measurements, which, although possessing interest as solving a geographical problem, must necessarily postpone the period at which I could submit, to those in whose service I was employed, my final report as to the feasibility of this project. I therefore aimed at nothing more than to disprove the existence of the high mountain chain which has hitherto been supposed to lie between, and parallel to, the San Juan and the Pacific Coast. The non-existence of such a range is not only rendered probable by the moderate elevation at the point at which we crossed; but is, I conceive, fully demonstrated by the fact that none was visible from either the Baudó or the San Juan.

The broad level tracts to the west of the San Juan, or to the east of the Baudó, would frequently have afforded an uninterrupted view of any important elevation; especially when we were descending reaches of the river, running nearly north-west and south-east; in the same manner that those of the Atrato had enabled us to trace the course of the Western Cordilleras, at a far greater distance.

The ridge of partition here presents a character essentially different from that of the atravesia at the head of the Pató. We found the rate of ascent from the house to near the summit, to be very gradual. Throughout this portion, the pathway runs nearly parallel to a rivulet-branch of the Pepé, the fall of which is by no means precipitous. Its bed does not show the round siliceous pebbles of the main stream, but merely flat ones of the indurated gray clay. At the head of this little branch we came to the ridge itself, which is but a trifling hill, apparently less than 150 feet in height, where the path crosses it; and even some 30 or 40 feet lower within a few rods distance.

Large canoes are frequently dragged across here, with very little trouble. Two had thus passed the day before. We did not see any siliceous pebbles in crossing the western slope of this ridge, which consists chiefly of gray and yellow clay. The pathway down the eastern slope is steeper than on the western; and at points where the stratification was exposed to some depth, we found the lowest strata to be perfectly formed hard rock, consisting of cemented sand, gravel, and paving pebbles. Their strike appeared to be about N. E. and S. W., with a dip to the S. E. of about 55 degrees. We saw no boulders on either side.

At the east foot of the hill we found our men waiting with a boat, in a small creek, called the Arastradéro, tributary to the Surúcco; but as the stream then afforded too little water to float the loaded canoe, we had to

follow it about half a mile down, on foot, before we could embark. Its name is derived from the Spanish "arastrar," to drag; and probably has reference to the portage across which canoes are dragged. It runs about eight miles before uniting with the Surúcco; and throughout this distance, it is but barely adapted to large canoes. After receiving the waters of the Surúcco, it becomes a very respectable ranchada stream; while the addition of the Basurú, at some four and a half miles above the entrance into the San Juan, gives it an ordinary width of 50 feet, with a mid-channel depth of 4 or 5 feet. Before reaching the San Juan, the average width becomes about 100 feet; but it is much obstructed in places by logs and bars.

I have before alluded to the partition ridge as having, in my opinion, interposed a barrier to a further dispersion westward of the gold bearing drift, or diluvium, which, descending from the Western Cordilleras, has, like an immense flood, swept over the face of the intermediate region, showing itself at all points except where the more recent alluvial accumulations have covered it. In proof of this, we descended the Arastradéro but a very short distance before meeting with the gold-bearing clay and gravel.

We stopped for a short time at the hut at which our men had, on the preceding day, obtained the boat we were now using; and on my remarking to the colored master of the house, that the appearance of the soil indicated the presence of gold, he told me that the women of his family were at that moment washing for it in the immediate vicinity; and on my expressing a desire to see the operation, he somewhat reluctantly offered to accompany me to the spot. This we found to be a deep deposit of gold-gravel and whitish clay, at least 25 feet thick, that being the height to which we ascended it above the level of the stream.

As our party emerged from the bushes on one side of the field of action, we caught a glimpse of the loose ends of some half a dozen diapers, "streaming like meteors to the troubled air," as the sable damsels who wore them, startled by our approach, suddenly dashed into cover on the opposite side.

The old man, however, after much persuasion, and an assurance from our patron, that we (the Doctor and myself,) intended him no harm, took up one of the wooden bowls, and filling it with the gravel, washed it hastily and presented the result for our inspection. In doing so, he trembled to such a degree that I thought he would let the bowl drop. He evidently mistook us for government spies, or some other obnoxious officials; and to my question as to how much gold a person could collect in a day, he replied in a deprecating tone, not more than one or two dollars.

Convinced, from the sample he had shown, that this was entirely under the mark, and wishing to obtain some rude data for estimating the richness of the deposit at this distance from its place of origin, I offered him two dollars if he would wash for me for a quarter of an hour. He declined, however, in the most positive manner. We afterwards witnessed the same repugnance in other localities; and on several occasions should have failed in our endeavors to purchase specimens, but for the timely intercession of our patron and bogas.

About four miles above the San Juan, we passed the Rock of the Virgin

of the Surúcco. This is a vertical face of tough gray sand-stone, about 25 feet high, on the north bank of the stream. It is dedicated to the Virgin; and in a rudely dressed little niche, half-way up it, burning candles are frequently deposited to her honor, and to propitiate her protection during the navigation of the stream. Three were burning in it as we passed; and as our men expressed a desire to stop a few minutes from motives of respect to the sanctity of the spot, we permitted them to do so; and at the same time we ascertained the strike of the strata to be about N. 30° E., with a nearly vertical dip.

We reached the San Juan at 3 o'clock, P. M., having expended four hours in actual boating, at the rate of about three and a half miles per hour. This gives 14 miles, measured along the sinuosities of the stream; or, as we judged at the time, about 8 miles in a direct line from the eastern foot of the dividing ridge to the San Juan; or 11 miles from where we left the Pepé. Throughout the greater part of its course, the lands adjacent to the stream are flat and wet; especially for some few miles before reaching the San Juan, where they are perfect marsh.

We found the mouth of the Surúcco to be about two and a half leagues below the town of San Pablo. On account of the current, and some bad rapids which occur in this interval, we required three hours of hard poling to traverse it; still, we arrived at the town, as our friend at the Pepé had predicted, a little while before the afternoon rain commenced.

Regarding this outline of our detour by way of the Pató, Baudó, and Surúcco, as an episode in the narrative of the main route from ocean to ocean, by way of the Atrato and San Juan, I will terminate it at this point; and recommence at Quibdó, at which place we had diverged from our prescribed path.

We returned to Quibdó by way of the Santa Mónica, the San Pablo, and the Quito, which under these names form the main westerly branch of the Atrato. (See Map, Plate XII.)

Throughout our absence of seventeen days, we had, with but very few exceptions, escaped the annoyance of heavy rains *during the day;* but as we approached within two or three miles of Quibdó, at 3 o'clock, P. M., it seemed as if the old town was determined to reassert, at once, its supremacy in the matter of water privileges; for the rain actually appeared for a while to descend in a solid mass, completely shutting out the river banks from our sight; and causing us a good deal of trouble to keep our boat afloat by bailing.

I suspect that the pre-eminence which we accorded to Quibdó over the adjacent region, in the rain line, is not owing to a casual excess during our stay; but more probably to its position at the confluence of three considerable streams, which, in the aggregate, expose a large superficies of water to the action of the atmosphere. I have frequently had occasion to remark, in tropical regions, that the prevalence of rain in particular localities, is very sensibly affected by the presence of sheets of water, even when of quite restricted dimensions. I may instance, for example, a lagoon some ten or twelve leagues inland from Carthagena, New Granada, in which I once spent several consecutive months *of a dry season*, on board of a dredging-machine. During this period, we had more or less rain, sometimes very violent, and frequently attended with much thunder

and lightning, for three or four days in every week; while, at the distance of but 6 or 8 miles from us, in dry localities, not a drop of rain fell throughout the entire interval.

On another occasion, I was stationed for some months about midway between two small lagoons eight miles apart. Here, during the dry season, three or four morning rains would fall over one of the lagoons, and three or four afternoon ones over the other, almost every week; while the midway station would receive but one or two light showers, generally of but a few minutes duration, in the same time.

The constant humidity of the air, at Quibdó especially, is a source of many annoyances. The store-keepers experience much difficulty in protecting their dry goods from its injurious effects; and frequently sustain losses from mould, and from the running together or fading of the colors of many of their fabrics.

Many articles of groceries likewise deteriorate rapidly under its influence. Your table salt is semi-fluid; and spices generally, after being a short time on hand, might almost be mistaken for ingenious imitations in white pine, as they nearly lose all flavor.

The clothes in our trunks were constantly damp and mouldy, although we spread them out in the sun whenever an opportunity presented itself. Satin and velvet appeared to be soonest injured. Also, any article of leather or morocco, such as boots, dressing and instrument cases, &c., contracted mould with great rapidity; and had to be overhauled and cleaned every day or two. Even the strongly scented Russia leather with which I had taken the precaution to have my note-books bound, suffered much from this source, although kept in a close box, and well wrapped in paper.

Had not Mr. McCann attended carefully to the airing of the effects left behind by Dr. Halsted and myself during our absence, I suspect that most of them would have been ruined.

The blue-lines of our ruled paper soon became nearly obliterated, although the red ones did not appear to be affected. The rust had to be cleaned from the steel portions of my drawing instruments whenever I used them; and many minor articles, "warranted to keep in any climate," such as soft water-colors, Seidlitz powders, water-proof lucifer matches, &c., soon became nearly worthless.

I should certainly recommend a portable sheet-iron stove as a very essential contribution to not only the comfort, but the health, of any person who may be doomed hereafter to undergo a sojourn of even a few weeks at Quibdó. Its use would, of course, be confined chiefly to the drying of wearing apparel and bed clothes.

With the exception of light chills and fevers, the climate was represented to us as by no means very prejudicial to the health of the natives; and we certainly saw nothing to suggest doubts of the assertion; neither did any of our party (all, however, previously well acclimated,) experience any sickness. But of some few foreign travelers coming from the interior, whom we encountered here, all were prostrated by fever. It is true, that in their cases, the sickness was probably induced or aggravated in a great measure by the privations and fatigue necessarily attendant

on traveling across this country; still, I cannot conceive that this region can be other than prejudicial to the general health of those who, having previously lived on dry land, suddenly find themselves compelled to assume an amphibious nature and habits.

A great number of the lower classes are, it is true, affected by cutaneous eruptions covering their whole bodies, and probably incident upon their constant exposure to wet; but I did not perceive that they suffered pain, or even inconvenience therefrom. We could not, however, fail to observe a prevalence of mild chills and fevers, among this class especially.

On arriving a second time at Quibdó, I immediately sat about making arrangements for reascending the river to San Pablo, and from thence prosecuting my exploration of the San Juan.

Our patron, Pedro Rociles, had so strongly recommended himself to us by his untiring industry, fidelity, and acquiescence to all our wishes, that I at once re-secured his services, and commissioned him to engage a boat and bogas; or more properly, peones, as the term bogas applies more strictly to those who manage the large trading boats from Carthagena.

The understanding was, that all should be ready within three days; but, as usual, one difficulty after another presented itself, detaining us in Quibdó for twelve days.

Time hung heavily on our hands during the interval; for, as the successive procrastinations were but for a day or two, we could not devote them to boating excursions of sufficient extent to be of service; and, as to pedestrianism, there is no ground to walk on.

During one of our delays, however, Dr. Halsted distinguished himself by a skilful amputation of an arm of a poor boga, who was accidentally shot in sport, by one of his comrades.

We also experimented, unsuccessfully, on various animals, with the Indian poison. As an apology for its inefficiency, I should, however, state that they are said to employ a more deadly kind when *men* are the game pursued. They use both kinds, not only on the long arrows of their bows, but on the short ones of their bodoqueras, or blow-guns, in the use of which they are very expert.

These blow-guns are made by tieing together two strips of palm, some three or four yards long; in each of which a semi-circular groove, about an inch in diameter, has been previously hollowed out with great care.

At this period, too, Father Ochóa, (nothing abashed by the inauspicious result of his communications respecting the height of the ridge between the Pató and the Baudó,) endeavored to prevail on me to take him with me to explore the routes by way of the Arquia and Cacarica lagoons, near the mouth of the Atrato. The only pre-requisite insisted on was, that I should provide him with a few hundred bright gold dollar pieces, for propitiating the favor of the wild Cunos Indians who inhabit the interior mountains of that region; and over whom he assured me he could exercise unlimited control.

On this condition, he guaranteed to carry me from the Atrato to the beach of the Pacific, within the time that I could smoke a single segar.

There is a magnificent route for you, gentle reader; and a brilliant chance for distinction, for some future explorer.

Many speculations have been urged upon the public respecting these routes, as well as those by way of the Napipi, and the San Juan. I imagine that they have their origin in the following circumstance: the mountains to the west of the mouth of the Cacarica, suddenly deviate from their north and south trend, and, making a great bend to the south-west, stretch over towards the Pacific; leaving an immense expanse of marsh between themselves and the Atrato. (See Map.)

Spread over this marshy tract, are interspersed many lagoons of considerable area. These are drained into the Atrato by several caños which enter that river at points comprised between the Tequerré on the south, and the Arquia on the north. The last is not shown on my map, inasmuch as I did not see it, probably from its entrance being hidden by the long grammalote grass. It enters the Atrato not many leagues above the mouth of that river.

Now, to a person looking westward from any point on the Atrato, south of the Cacarica, the mountains appear to become lower, and finally to subside altogether, as they approach the Pacific. There are not, however, the slightest grounds for imputing this effect to any other cause than the optical illusion which invariably attends all such cases; and the assumption of it as proof of a depression in the mountains, is at least untenable.

I certainly could not perceive, from either the Atrato or the Pacific, the most faint direct indication of the existence of any such depression.

The Indians of the mountains, and of the Pacific shore, do certainly visit the Atrato with their canoes, passing through all the ca os above mentioned. No one, however, could inform me, *positively*, whether they employed different sets of canoes on the opposite sides of the isthmus; or whether they dragged them across the intervening ridge. Even the latter case would constitute no argument whatever, against the existence of a continuous mountain range; inasmuch as the transportation of their canoes across mountains is not here regarded as at all an onerous task.

I do not, however, doubt that the mountains can be much more readily crossed almost any where along this great bend in their course, than at any point more to the north; and there is every reason to suppose that the Indians have here atravesias, or crossing-places of comparatively easy transit.

A perfect level depression *may* exist, but there is no reason to suspect it.

At the end of the first stipulated three days, Pedro called to inform us that his wife was sick, and probably would not recover for at least two days more; and, of course, that respite was allowed. When it had expired, he again visited us with the announcement that his children had been attacked with the chills and fever. In consideration of this fresh affliction, we postponed our departure for two days more. But when they had passed, the family had not recovered sufficiently to justify Pedro in leaving them to their own resources on the banks of the Munguidó, where attentive neighbors were not only few and far between, but endued withal with that peculiar temperament which would have derived much more gratification from guzzling guarapo over the mortal remains of his pro-

geny, during the absence of their honored sire, than from presenting them to him in restored health on his return.

His own inventive faculties, however, suggested a resource in this dilemma. He had a bosom friend, who, in consideration of three reales (about 30 cents) a-day, would remain with his wife during our trip, and show her every attention that she could receive from himself. As I considered this very cheap, in view of the arduous services that the lady would probably exact, I sent Pedro forth to inform his substitute that I would cheerfully contribute the three reales per day.

But, in consequence of the immense extent of Quibdó, or perhaps from having sunk in a marsh, or being lost in a fog, or some other equally credible reason, he did not find his way back to our house until next day. He had, however, had an interview with his friend during the interval; and had ascertained that the undying affection of his Pythias was some 70 per cent. more valuable than he had estimated it at, and was not to be hired out under five reales per day; the two additional ones being (theoretically) to be applied to the payment of his meals while sojourning at his friend's house.

Being very impatient to start, I, of course, did not demur at the strike: but at once despatched Pedro with the most strict injunctions, to have every thing ready for our departure by sunrise on the next morning. Possibly, I did not express myself in very good Spanish; for instead of next morning, he came the next evening; and instead of having every thing ready, he had nothing ready. He had however just now recollected, that the boat had no toldo; and as to-morrow was Saturday, it would be utterly impossible, save by superhuman energy, to complete one in time for Monday, inasmuch as the peones whom he had engaged were pious men, and could not be induced to work at it on the Sabbath. But fortunately they had authorized him to state, that if I would allow them double pay for Saturday, they would put forth the superhuman effort required, and by doing two days' work in one, would be ready by sunrise on Monday.

I at once advanced the extra pay; but on receipt thereof, the religious zeal of the peones waxed faint. They indulged in a spree on Saturday: but atoned for it by working at the toldo, like Trojans, on Sunday; and brought the boat to our landing on Sunday evening.

Having experienced much inconvenience from the want of height in our other toldo, which did not admit of our sitting upright under it, we had especially enjoined upon Pedro the necessity of making this one about four inches higher, and had given him a twig four inches long as a guide. We found, however, that it was precisely the same as the other; and on censuring him for the oversight, he referred us to the peones, who had constructed it, and to whom he had communicated our orders. They assured us that they could not do otherwise than they had, inasmuch as the present height was in conformity with the "costumbre del pais." This is an argument that admits of no rejoinder, and we had to be content accordingly.

The boat was no larger than the one we had used before, and as in view of our longer intended absence this time, we were burdened with more baggage, it again became necessary to leave Mr. McCann behind.

His detention, however, was attended by the satisfaction that we thereby secured a more extended series of observations on the river, inasmuch as he kept a regular table of its fluctuations.

Although Dr. Halsted and myself were in readiness by daylight, yet our peones contrived to delay our departure until near noon. They had put off their purchases of provisions until now, on the plea that perhaps we might, after all, change our minds and not go.

We had every reason to believe that the unexpected shuffling conduct of Pedro had been dictated (on the principle of sharing the spoils,) by one of our best apparent friends, whose station should, in the most special manner, have shielded him from any such imputation.

It is even probable that we should have been subjected to still further delay, had it not been for the interference of the Governor, and Dr. Key.

When we descended the river twelve days before, we saw it in a stage of high flood; but now as we commenced our ascent of it, at noon of August 17th, it was at rather a low one, giving but eight feet in mid-channel at Quibdó.

It will be remembered that I now refer to the Western branch of the River, which at Quibdó, takes the name of Quíto; that of Atrato being retained by the Eastern branch.

I have before stated, that the *ordinary* stages of the Atrato at Quibdó may be regarded as fluctuating between ten and sixteen feet in mid-channel; and that there are probably not more than thirty days in the year, (of irregular recurrence,) when it affords less than seven feet in the deepest part of its cross-section at that place; although liable, for a few days every year, to become reduced to but scant three feet, which may also be regarded as the least extreme low water channel depth at any point below the town; but of course occurs at more frequent intervals above it.

The Quíto, from Quibdó, to the Pató. While the river was in this low stage of but eight feet maximum depth at Quibdó, we found that seven feet could be carried up the Quíto all the way to the mouth of the Pató, or seventeen miles. By far the longer portion of the distance indeed, gave us greater depths, as we nearly every where could pick out a channel with from eight to ten feet, thus proving that at ordinary times the Quíto would thus far afford at least ten or twelve feet.

When the stream was in high flood, at the time of our descent, some two weeks before, we had found as much as 18 feet, not only from the Pató to Quibdó, but above the Pató as far as the junction of the Certigui and San Pablo, or 32 miles above Quibdó. At that time, the current was about three miles per hour in mid-channel at both the Pató and the San Pablo, and, indeed, up to the head. It must however be borne in mind, that as we ascend, the channel becomes much narrower, as well as more circuitous, and encumbered with bars; and would consequently require skilful pilots to navigate it with security. In many places we found the eight or nine feet channel depth, to be confined within a width of from 75 to 100 feet; and with a shifting bed.

The width of the stream varies a good deal; but for some miles below the Pató it may generally be regarded as from 100 to 150 yards. At the Loma de los Palacios, or Hill of the Palaces, (a gravel bank about

half a league below the Pató,) it is contracted to 70 yards; and at one spot just below the Paymado, it was but 100 feet when we ascended.

The descent of the Quíto, taken with the spirit-level at a point about three miles below the Pató, was at the rate of 20 inches per mile.

At the time of this visit, the bar at the mouth of the Pató was bare; and some twenty black women and children were washing fine gold dust from the gravel thus exposed.

We had also seen a party similarly engaged, with their calabashes and wooden bowls, on a bar some two leagues above Quibdó. In this immediate vicinity, they can only work to advantage when a low condition of the water exposes shoal places in the bed of the river. In other positions, the marsh mud, and other alluvial deposits, have buried the wide spread auriferous diluvium beyond their reach, except in certain spots where it shows itself in elevated bluffs along the river. But, until we ascend to near the sources of the streams, where the water is at nearly all times shallow, these bluffs almost universally form the steep sides of sudden bends, and descend precipitously into too great a depth of water to admit of being worked by the primitive means at the disposal of these people. I believe I have before stated, that gold is obtained in small quantities from the river gravel at Quibdó, whenever the water becomes sufficiently low for the purpose; and that the authorities had been compelled to forbid the digging of holes around the town, which is situated on a bluff, of gold-bearing gravel.

The entire bed of the Quíto, together with those of its eastern tributaries, and of all the streams between it and the Western Cordilleras, are throughout, rich in gold. It is not, however, until we approach to within a few leagues of the Cordilleras, that the particles assume a size larger than what is generally known as gold dust. I procured specimens from many localities far apart, and invariably found them to be accompanied by the black ferruginous sand; and, generally, by platina. In all cases, the gold was remarkably pure. Wherever bluffs of gravel show themselves along the river above Quibdó, they contain gold.

The Quíto, from the Pato to the confluence of the San Pablo and Certigui, a distance of 15 miles; or 32 miles above Quibdó.

Above the confluence of the Cértigui, the Quíto loses its name, and is called the San Pablo.

Its width here is but about one-half as great as at the Pató, being on an average but about 50 or 60 yards. Its bed, however, is depressed to nearly the same distance below the tops of the average levees at both points, namely, some 18 or 20 feet in mid channel. Consequently, inasmuch as the highest floods barely overtop these levees by some two feet, the greatest depth of channel-way in heavy freshets, is nearly uniform throughout the intermediate distance. But a greater *ordinary* channel depth than some seven feet, could not be safely calculated on, although by the removal of a single short gravel bar about a mile below the confluence, this might be increased to nine feet; or nearly as great as that assumed up to the Pató; and with nearly as great a width, or from 60 to 80 feet. Ordinary depths of from 10 to 14 feet, however, are by no means of unfrequent occurrence up to here, the bed being quite irregular.

We had carefully observed the bends of the stream, and judged that at ordinary stages, a steamboat 150 feet long could pass around all that we had seen up to this point.

Our spirit-level, here indicated a fall of about 2½ feet to a mile.

Thus it appears that, were it not for the incessant fluctuations of this stream, which, within a few hours, frequently reduce it from its *ordinary* ample channel depth, to one of but 5 or 6 feet, and sometimes of but 3 or 4 feet, the Quíto would present a magnificent steamboat thoroughfare to this point, which is, by my computation, 252 miles above the Gulf of Urabá, at Boca Coquíto.

But at these low stages, which recur at periods altogether irregular, the width, as well as the depth, of channel-way becomes very much reduced; converting the Quíto, indeed, into a mere respectable brook, barely sufficing for the larger ranchadas of the country. Moreover, the fluctuations in this branch of the Atrato are subject to much more frequent changes than the portion below Quibdó; the latter being maintained in a *comparatively* equable regimen by the more constant and copious rains which fall on the Western slope of the Cordilleras.

The shifting of the bars, and the number of sunken trees, which increases as we ascend, tend still further to embarrass the navigation at low stages of water. Great numbers of these trees would have to be removed, were steamboats, even of small size, to be introduced. Above the Certigui, the bed of the stream may be said, without exaggeration, to be literally covered with them.

(To be Continued.)

Translated for the Journal of the Franklin Institute.

New Instrument for Rapid Surveying.

M. Porro, certainly the most indefatigable inventor among civil engineers, has just submitted to the inspection of the Academy of Sciences at Paris, some new instruments, "for rapid surveying, with general and simultaneous leveling, and reference by rectangular co-ordinates to the meridian, and level of the sea." "These instruments permit the determination, by a single observation at a single station of the three polar co-ordinates of a point in space, and the transformation of these, without what is properly called calculation, into the rectangular co-ordinates, the time necessary for this does not exceed two minutes for each point. The degree of accuracy obtainable, is $\frac{1}{5000}$th for the smaller, and from one-thousandth, to the quarter of one-thousandth for the other."

These instruments are said to be summarily described in the *Annales des Ponts et Chaussées*, but we regret that M. Porro, in view of their great importance (if true,) has not described them minutely in some more accessible publication. The method in which he speaks of them in his communication to the Academy, does not convey to a foreigner any very clear ideas of their theory or construction, as may be judged of by the following extract: "The optical part of this apparatus consists in splitting the *anallatizing* glass of any *diastimometric* telescopes, &c." When we recovered from this description, which requires for its comprehension much more knowledge than we lay claim too, we found a remembrance

germinated in our minds, (like a crystal in a saturated solution after an electric discharge,) of the instrument of M. Villeroi, described in this *Journal*, (Vol. XVIII, p. 238, Third Series). In this the object glass was divided, and in consequence the distance of a point could be determined by using a double target, of which one was sliding. But whether this glass was *anallatizing*, or whether the telescope was *diastimometric*, that is what we cannot say.

By the way, we remember, that about the time that M. Villeroi exhibited his plan to the Franklin Institute, Mr. G. Escol Sellers communicated to us, confidentially, a plan which appeared to us much better, for accomplishing the same end, that is, the determination of distances by a single observation and without chaining. What has become of it?—Ed.

AMERICAN PATENTS.

List of American Patents which issued from June 20th, to July 11th, 1854, (inclusive,) with Exemplifications by Charles M. Keller, *late Chief Examiner of Patents in the U. S. Patent Office.*

JUNE 20.

124. For an *Improved Tool Handle;* George W. Griswold, Carbondale, Pennsylvania.

Claim.—"I claim so combining a double acting pawl and star-shaped ratchet with the stock and handle of a screw driver or gimlet, as that by pressing the thumb or finger on one arm of the pawl, and turning the handle, the screw may be driven into the wood, and by shifting the thumb or finger on the other arm of the pawl, and continuing to turn the handle in the same direction, the screw or gimlet shall be drawn out of the wood, substantially as described."

125. For an *Improvement in Producing Continuous Circular from Reciprocating Rectilinear Motion;* Charles S. Harris, Holyoke, Massachusetts.

Claim.—"I do not claim a rack and pinion, or the duplication of the same, or a combination of two racks and pinions, or two racks and semi-pinion, so applied as to produce circular motion from a rectilinear motion; nor the combination of a bow and string or band with a pulley for obtaining a circular motion from a rectilinear motion, nor the mere duplication of such devices; but what I do claim is, the so combining with the bow or bar and the two bands and the handle, or its equivalent, a vibratory or rocker lever, that during the reciprocating rectilinear movements of the bow or bar, caused by the power applied to such rocker lever, it shall be made to operate so as to alternately tighten and loosen each cord upon the pulleys of the drill stock, as specified, and so to cause the drill stock to be rotated."

126. For an *Improvement in Cast Iron Car Wheels;* John Henry, Lynchburgh, Va.

Claim.—"I do not claim a central plate running from the hub to the rim, and not connected with the inner and outer plates, as such a wheel was patented by Fred. Warback, November 6th, 1847; but what I do claim is, the intermediate continuous plate, extending diagonally from the hub to the rim, (in a cast iron wheel having double plates or disks,) and connecting the two plates of the wheel together, substantially as described."

127. For *Extra Yard to Topsails;* Frederick Howes, Yarmouth, Massachusetts.

Claim.—"I claim the application of an extra yard, supported by truss, crane, or brace, as described, or any other substantially the same, and which will produce the same effect."

128. For an *Improvement in Carriage Tops;* Solomon F. Huntington, Syracuse, N. Y.

Claim.—"I claim the method of supporting the top by means of an inverted bow inside the covering of the top, and attached to or standing upon the back of the seat, and

having its ends firmly attached to the back bow of the top, or any other analogous device effecting the same object. In connexion with this, I claim the method of dropping the top by detaching this bow from the back of the seat, and supporting it in proper position when dropped, by flexible or elastic stays. Also, the extension of the jointed brace forward of the front bow in such a manner as to form a handle or lever within reach of a person in the carriage, and by which the brace may be worked, substantially as described."

129. For an *Improvement in the Mode of Moulding Bricks;* Nathan Johnson, Noblesville, Indiana.

Claim.—"I claim the mode of at once distributing the mortar, filling the moulds, and removing the surplus material, viz: by means of the lute, applied as described. I claim further, that with them bricks can be made without the assistance of off-bearers, and at one-fourth less expense than they can be made in any other way."

130. For an *Improvement in Gas Metres and Regulators;* Charles C. Lloyd, Philadelphia, Pennsylvania.

Claim.—"I claim the application of the principle or mode of operation herein described, whereby the double purpose is effected of equalizing or regulating the pressure of the gas within the metre, and of shutting off the gas when the water gets too low, by combining the valves with one and the same float, all within the metre, substantially as described."

131. For an *Improvement in Painters' Brushes;* John S. Martin, Boston, Mass.

"The nature of my invention consists in providing the bristles of the brush with an elastic binder, to extend from their connexion with the handle and around the pack, and down toward the point or working end of the brush."

Claim.—"I claim the application of an elastic binder to a brush, instead of an inelastic cord or binder, as commonly used, the said elastic binder being composed of caoutchouc, or other suitable material or materials."

132. For an *Improvement in Radial Arms for Car Brakes;* Thomas G. McLaughlin, Philadelphia, Pennsylvania.

Claim.—"I am aware that a radial arm, turning loosely on the brake lever shaft of the tender, and raised to a horizontal position by a spring and lever, in connexion with the means of operating the brakes of the tender to which it was attached, has been patented; therefore, I do not claim the means for raising the radial arms, as herein described; but I do claim the employment of the radial arms, in combination with the catches or lips formed on the radial arms, for the purpose of relieving the horizontal shaft on which the radial arms are firmly secured, of the pressure or force which may be exerted against the ends of the radial arms, when operating the brakes of the several cars in a train, by the means that have been heretofore invented by me for that purpose."

133. For an *Improved Burglars' Alarm;* Duncan E. McDonald, Springfield, Mass.

Claim.—"The arrangement of the clamp, brace, guard, and plate, for securing doors and windows being already patented by me, May 31, 1853, I do not, therefore, claim the said device of the clamp, brace, guard, and plate, for the above purpose; but what I do claim is, the clamp, brace and guard, and plate, in combination with the hammer, the spring, and dog; the above parts being constructed and arranged in the manner set forth."

134. For an *Improvement in Steam Engine Regulators;* Anson Merriman, Middletown, Connecticut.

"The nature of my invention consists in an apparatus for regulating the flow of steam to the steam cylinder, and thereby to determine the velocity of the engine according to the work it is to perform."

Claim.—"I claim the chamber, cock and safety valve, holding a portion of steam in store, and in combination with the pump drawing from and returning it to the same source, and acting on the piston during the dead points of the engine. 2d, The aperture, chamber, and safety valve, so weighted as to hold the steam at greater pressure than in the boiler, in combination with the pump or pumps for forcing the steam into the said chamber for forming a magazine to feed the cylinder at the moment the engine is passing the dead points, and operating in the manner described."

135. For an *Improved Watch Chain Swivel;* Nathan F. Mathewson, Providence, R. I.

Claim.—"I claim constructing the spring inclosing slide with the smaller or opening section of the loop fast to it, and gearing the said slide by square or angular recess in it, and corresponding shaped shoulder on the shank, with the main section of the loop for operation together, in the manner specified, whereby the hook is opened and closed with greater facility, and the opening section firmly held in its open position without applying the finger or hand thereto, and without destroying the loop form of the hook, and without employing a cross swivel joint in the loop, as described."

136. For an *Improved Slate Frame;* Edmund Morris, Burlington, New Jersey.

Claim.—"I claim constructing a slate frame of corresponding halves, of such a shape that a single joint combines them with each other, at the same time that it firmly secures the slate between them."

137. For an *Improvement in Breast Pump;* Oswell H. Needham, City of New York.

Claim.—"I claim the combination of an air pump, operating with a nipple shield or cupping shield, made of flexible material, substantially in the manner set forth, by means of a flexible tube, so that the motion of the working of the pump will not be felt upon the parts operated upon, so that the patient can operate it herself, and regulate the action in a manner never before effected."

138. For an *Improved Method of Turning Casks, &c., from Solid Pieces;* James P. Osborn, Staunton, New Jersey.

Claim.—"I do not claim the making of the bodies of barrels, casks, tubs, &c., by turning them in one piece out of the solid block; but I claim, 1st, The tool bearers, cutting in contrary directions, in combination with the cross heads, in the manner described. 2d, The combination of the cross heads with the connecting rods and feed screws, in the manner as described; and, 3d, The method, substantially as described, of adjusting the position of the tool bearers."

139. For an *Improvement in Cast Iron Vises;* Chas. Parker, Meriden, Connecticut.

Claim.—"I claim casting the movable jaw or chap of a vise so as to inclose and secure by the operation, one or more wrought iron bars within the tail or guide rod, at or near the point of greatest strain; said bars being enlarged or bent at the ends, the better to secure the same to the casting, in order to act as a chord or chords to resist tensile strain, and thereby secure the maximum of strength with the minimum of metal, as described."

140. For an *Improvement in Railroad Car Brakes;* Benjamin F. Reimer, Philadelphia, Pennsylvania.

Claim.—"I claim the brake, consisting of a perpendicular rod, the guides, the rollers, the chain, and the mode of attachment, the whole being arranged substantially as described, for the purpose of operating either by the mechanism for acting simultaneously upon all the brakes in the train, or independent of the same by the lever."

141. For an *Improved Arrangement of Ships' Capstan and Windlass;* Jesse Reed, Marshfield, Massachusetts.

Claim.—"I claim the arrangement of the movable capstan with the two windlasses, constructed and operating in the manner set forth, so that either windlass may be turned in either direction, by operating upon the single capstan."

142. For a *Machine for Drying Grain;* S. Brockway Robinson, Oswego, New York.

Claim—"I claim a trough or cylinder with a perforated bottom, provided with a conveyor or stirrer, in combination with a blast of heated air, forced through the perforated bottom."

143. For an *Improvement in Tentering Cloth;* Warren Shaw and Parley G. Green, Wales, Massachusetts.

Claim.—"We claim the adjustable obliquely situated tenter wheels, provided with laterally playing tenter points, in combination with the oscillating guides, arranged and operating in such a manner as to seize the cloth and stretch it uniformly, at the same time bringing its edges perfectly even and straight, in which condition it is delivered to the tenter points of the drying apparatus, to be retained thus till dried and received by the folding apparatus."

144. For an *Improvement in Gas Retorts;* Adrian R. Terry, Detroit, Michigan.

Claim.—"I claim the application to gas retorts of a coating which consists of a series of layers or laminæ of luting and metallic wrapping, substantially as specified."

145. For *Application of Ordinary and Superheated Steam Combined for Heating Purposes;* Chas. E. Wethered, John Wethered, and Sam. Wethered, Baltimore, Maryland.

Claim.—"We claim the application of the combination of ordinary steam and superheated steam, (which combination is effected by bringing them together in pipes of any convenient form, before or at the point where their contents are discharged,) for the purpose of boiling, evaporating, drying, melting, and heating."

146. For an *Improved Mode of Raising and letting Fall Carriage Tops;* Jos. R. Winchester, Medina, New York.

Claim.—"I claim the cross brace attached to the outside braces and the centre part of the outside braces, performing, as it does, the office of a double brace, and the two attached to a carriage top or cover, in connexion with the other portions of the outside braces, will produce the desired effect."

147. For an *Improvement in Folding and Measuring Cloth;* William C. Wright, Boston, Massachusetts.

Claim.—"I claim, 1st, Making the folding table of a machine for folding and measuring cloth, to move with a reciprocating motion, so as to make the folds and determine their length, and also the making said motion adjustable, in order to change the length of the folds to be made and measured. 2d, The combination of the moving folding table, operating as specified, with the guiding folders and elongated holders to each side of the table, for folding and guiding the cloth to be folded, and holding it as set forth. 3d, Making the said holder adjustable upon the ends of the folding table, so as to accommodate different lengths of folds. 4th, Relieving the cloth when folded from the folders and holders, so that it may be removed from the folding table by raising all of them simultaneously by means of the treadle connected to the said folders and holders, through the mechanism above described."

148. For a *Mode of Setting and Holding Pens for Paper Ruling;* S. W. Collins, Charlestown, Mass., Assignor to W. O. Hickok, Harrisburg, Pennsylvania.

Claim.—"I claim the extension pens and adjusting beam constructed and combined in the manner set forth."

149. For an *Improvement in Machines for Cutting out Boot Soles;* Luther Hill, Stoneham, Assignor to Luther Hill and Lorenzo Stratton, Fentonville, Mass.

Claim.—"I do not claim the invention of a bed knife, nor the combination of a press platen, or follower therewith; nor the making the follower with its undue surface a plane surface for the purpose of stamping out soles from leather; but what I do claim is, combining with the under side of the follower and with the cutter, as described, a sole bender or former or projection in relief of the form necessary to bend the sole into the shape it is to have when fixed on a boot or shoe, the said sole former by bending the leather, causing its edges to stand perpendicularly to the plane of the outer edge of the upper surface of the concave side of the sole, as specified."

150. For an *Improvement in Omnibus Registers;* Levi W. Mallory, Assignor to Wm. Morris, Philadelphia, Pennsylvania.

Claim.—"I claim the combination of the rod, guide, lever, spring, coupling, and eccentric ratchet or trigger, operating substantially as set forth, to prevent the ringing of the bell until the fare is registered."

151. For an *Improvement in Padlocks;* Stephen White, Assignor to Henry C. Jones, Newark, New Jersey.

Claim.—"I do not claim simply notching one of the bolts to act as a stop for the reception of a tumbler or spring dog, or any equivalent, as this alone would not accomplish what my invention accomplishes. What I claim is, making the sliding bolt with a shoulder, or its equivalent, acting substantially as specified, in combination with the turning bolt, both entering the mortise of the shackel in opposite directions."

JUNE 27.

152. For an *Improvement in the Furnace of Steam Boilers;* Jonathan Amory and W. P. Parrott, Boston, Massachusetts.

Claim.—"We claim conducting off the carbonic acid gas, or other heavy and incombustible gases which check combustion, by means of a pipe which communicates with the bottom of the furnace, at or near one end of the same, and with the smoke pipe or flue, as described."

153. For an *Improvement in Cider Mills;* Jesse Bauman, Shepherdstown, Penna.

Claim.—"I claim the use of the wheel, provided with off-sets or planes, and teeth or spikes, as described, in combination with the springs, for grinding the fruit. 2d, The arrangement of the grinding wheel and springs with the cam, pressing box, and furnace drawer and spring, for the purpose of dressing the pulp and delivering the pomace. Lastly, I claim, in the secondary mill, the arrangement of the spring, concave, and cam shaped rasping wheel or grinder, for the purpose of reducing the fruit to a pulp."

154. For an *Improvement in Coffee Mills;* Chas. H. Beatty, Wheeling, Virginia.

"The nature of my invention or discovery consists in the construction of the crank or operating lever, which is made in two parts, parallel with each other."

Claim.—"I claim adjusting the movable grinder of coffee or spice mills, by a handle or lever composed of two parallel pieces and a tempering screw, substantially as described."

155. For an *Improved Grape Frame;* J. Oscar Cross, Kingsbury, New York.

Claim.—"I claim an adjustable elevating and depressing grape frame, with or without supporters attached, (made of any known material,) for the better cultivation of the grape, which is believed will secure all the advantages specified."

156. For an *Improvement in Gas and Liquid Regulators;* T. H. Dodge, Nashua, N. H.

Claim.—"I claim the employment for regulating the flow of gases and fluids of two chambers, having communications at top and bottom, and being partly filled with water or other liquid, and furnished with a valve and float, arranged and operating substantially as described."

157. For an *Improvement in Grass Harvesters;* George Esterly, Heart Prairie, Wis.

Claim.—"I do not claim the frame, nor the drivers' seat thereon, nor the tongue, nor the driving wheel, gearing, gearing shaft, nor the connecting rods, nor the shoe, nor the sickle beam, nor the sickle sill, nor the dividing finger, nor the lever; but what I claim is, 1st, The construction of the sickle in such manner as to have projections on alternate sections of the sickle sliding upon the bar, operating for the purposes set forth. 2d, I claim grinding off the raised or feather edge made by the chisel in cutting the sickle, as set forth. 3d, The attachment of plough to the sickle beam by a screw pivot to fit said plough to the surface of the soil, in the manner set forth."

158. For an *Improvement in Reversible Capstans;* Joel A. H. Ellis and Alexander Gordon, Rochester, New York.

Claim.—"We claim the shifting spur wheel connected to the shaft of the capstan by feathers, and operated by a lever, or its equivalent, for the purpose of reversing the direction of the barrel of the capstan, without reversing the direction of the sweeps, and giving said capstan an increased backward motion, substantially as described."

159. For an *Improvement in Breech Loading Fire Arms;* J. Darell Green, Cambridge, Massachusetts; patented in England, May 12, 1854.

Claim.—"I claim the self-adjusting thimble, constructed and operating in the manner substantially as described. 2d, The peculiar manner described, of locking the barrel to the breech, by means of the wedge formed ears and the hooks, in combination with the method described, of controlling the forward and revolving motion of the barrel by means of the cylinder, the sleeve, and the spindle, the whole being connected together by the key, in the manner set forth."

160. For an *Improvement in Bank Locks;* Wm. Hall, Boston, Massachusetts.

Claim.—"I do not claim inserting a key within a cavity in the lock, and raising it by direct pressure produced by a wedge, or other means, against the tumblers or against pins projecting therefrom, as this leaves the tumblers at all times exposed to be operated

upon by an instrument inserted at the key hole; but what I do claim is, the slotted sliders, which are allowed to arrange themselves upon the steps of the former to form the bits of the key, in combination with the pin, or its equivalent, when the tumblers are operated by turning the key, whereby the tumblers are rendered inaccessible to any instrument that may be inserted at the open key hole, and the latter is closed whenever the key is turned so as to bring the slides to bear upon the tumblers."

161. For an *Improved Seed Planter;* Daniel Hill, Bartonia, Indiana.

Claim.—"I claim the reversible directing board plane on one side, and furnished with converging slats or ridges on the reverse side, for the purpose of either drill or broad cast sowing."

162. For an *Improvement in Manufacturing Suspender Ends;* Julius Hotchkiss, Waterbury, Connecticut.

"The nature of my invention consists in attaching the straps to each end of the buckle, by a double connexion, whereby a self-adjusting action is obtained that adapts itself to the position of the body."

Claim.—"I claim the double attachment or connexion of the straps with the buckle, substantially as described."

163. For an *Improvement in Sewing Machines;* Walter Hunt, City of New York.

"Said improvement consists in the manner of feeding in of the cloth, and regulating the length of the stitch, solely by the vibrating motion of the needle."

Claim.—"I do not claim, broadly, in the sewing machine, the feeding of the material to be sewn by the needle; but what I do claim is, 1st, Sustaining both ends of the needle whilst moving the cloth to effect the feed, by means of an inclined guide made adjustable, and placed under or upon the shuttle side of the cloth, substantially as described. 2d, The rotary table top, in combination with the guides and ways underneath the same, all arranged and operating in the manner set forth."

164. For an *Improved Rotary Cultivator;* H. M. Johnson, Carlisle, Pennsylvania.

Claim.—"I do not claim disks or rotary colters, sharpened at their periphery, nor disks having transverse knives on their periphery; but what I claim is, a system of sharpened disks or rotary colters, a part of which are armed upon their periphery with knives projecting laterally; said knives being set obliquely to the radius of the disk, as described; the whole being combined and arranged in three several sets, so that the two sets armed with knives shall cut alternate sections of the soil."

165. For an *Improvement in Drying Cloth;* D. W. Kennedy, Staunton, Virginia.

Claim—"I do not claim the revolving reel or heads having the cloth to be dried wound spirally between the heads, with a continuous air space between the revolutions; nor do I claim, in itself, for drying cloth, the employment of a revolving hot air or steam drum; but I do claim the reel, constructed as described, in combination with the hot air or steam drum arranged upon its shaft, whereby the cloth near the shaft may be dried equally with that upon the outer diameter of the reel, and thus equalize the shrinkage of the cloth throughout its whole length, in the manner set forth."

166. For an *Improved Mitre Machine;* George W. La Bau, Jersey City, New Jersey.

Claim.—"I claim the combination and arrangement, in the manner described, or in any manner equivalent thereto, of the several specific parts, or their equivalents, of the described mitre machine, without limiting myself to any particular arrangement of parts."

167. For an *Improved Hydro-Pneumatic Force Pump;* A. B. Latta, Cincinnati, Ohio.

Claim.—"I claim, 1st, Discharging the air from the cylinder before the end of the stroke of the piston, to move beyond the end of the cylinder and into the enlarged chamber. 2d, Inclining the top of the water chambers upward from the end of the cylinder to the discharge valve, in the manner set forth. 3d, The protrusion of the piston from the end of the cylinder at the end of each stroke, in combination with the upward inclination of the top of the chamber leading to the discharge valve, for the purpose set forth."

168. For an *Improvement in Coffins;* John McF. Lyeth, Baltimore, Maryland.

Claim.—"I claim the method of constructing marble slab coffins, so that the joints shall be tight and strongly secured to each other and to the bottom, and when raised by the handles, the weight shall come upon the bottom slab, substantially as described."

169. For an *Improved Regulator of Gas Burners;* William Mallerd, Brooklyn, N. Y.

Claim.—"I claim, 1st, The perforated cups or partitions, with their edged rings encircling the perforation, in combination with the perforated disk, valve, and the pin points to support it. 2d, The series of two or more valve chambers, with their valves, as described, each succeeding valve having a smaller perforation than the preceding one, and a slight increase of weight. 3d, Making the holes in the jet so as to burn at low pressure, in combination with a regulator."

170. For an *Improvement in Gas Burners;* William Mallerd, Brooklyn, New York.

Claim.—"I claim, 1st, Making the tip where the jet or jets of gas are burnt, of pure tin, or other metals of which tin forms a large proportion, thickly coated with tin. 2d, Making the tube and inner portion of burners of tin, or any metal thickly coated with tin, to prevent corrosion, and to avoid the use of solder. 3d, Punching the holes through the tips or jets of the gas burners, instead of drilling or sawing, which can be done by a hand punch, but with more accuracy and despatch by a small machine, for which machine I have applied for letters patent in England, in October, 1853, to be taken out in Michael Hollins' name by Newton & Son. The punching of the holes creating a smoother channel, obviates all the difficulties caused by sawing or drilling."

171. For an *Improved Double-Acting Force Pump;* J. H. McGowan, Jr., Cincinnati, O.

Claim.—"I claim the combination of an air-chamber communicating with the pump above all the valves, with a vacuum chamber communicating with the pump below all the valves, whereby the elevation of water is rendered more equable, and effected with a saving of power."

172. For an *Improved Fruit Picker;* John Mellendy, Southbridge, Mass.

Claim.—"I am aware that a fruit picker has been made of a common fork with two bent tines, arranged on top of a pole, and a basket suspended underneath the tines. I am also aware that a fruit picker has been made of a cylindrical vessel placed on the top of a pole, and having its upper edge armed with angular teeth raised on it; I therefore do not claim any such contrivances; nor the combination of a bifurcated pole and a basket hung to it; but what I do claim is, the application of the star or serrated cover or separator and the sliding basket on the pole, so as to extend entirely around it on the pole, and so that the serrated cover shall be stationary, relatively to the pole, and the basket be made to slide or move towards and away from the cover, and be operated substantially as specified."

173. For an *Improvement in Inhaling Tubes;* Daniel Einthorn, City of New York.

Claim.—"I do not claim inhaling tubes, for they have been long known and used; but what I do claim is, the bottle or flask with an air tight stopper, and a tube with its lower end submerged into said fluid. And also the inhaling tube in combination with the flask and tube."

174. For an *Improvement in Machines for Cutting Brads;* Wm. J. Miller, Cold Spring, New York.

Claim.—"I claim the arrangement of the vibrating shear in relation to the revolving shears or cutters, as connected, so as to change the position of the cutting edge of the vibrating cutter, and cause it always to stand parallel with the edge of each revolving cutter until the nail has been cut, substantially as set forth."

175. For an *Improved Road Scraper and Spreader;* Thomas Penrose, Ellington, Ill.

Claim.—"I claim the tail-piece, with its adjustable brace, when combined with a flat scraper having the points of attachment of its draft chains at its lower edge, in the manner described."

176. For an *Improved Charger for Fire Arms;* T. H. Peavey, South Montville, Me.

Claim.—"I claim the charger, consisting of the chambered cylinder confined between two plates, to one of which is attached a muzzle piece, or some suitable means of fitting it to the barrel, and furnished with a spring catch, or its equivalent, by which the chamber may be severally held in communication with the holes in the plates and the muzzle piece, substantially as set forth."

177. For an *Improved Trap for Animals;* Oliver Pier, Harmony, New York.

Claim.—"I claim the lever treadle, set or fall, and the elbow catch latch, in combina-

tion with the single and double prong grapple, together with the folded spring, specifically as described."

178. For an *Improvement in the Manufacture of Wooden Buttons;* L. L. Platt and A. L. Platt, Newton, Connecticut.

Claim.—"We claim manufacturing wooden buttons by cutting the 'blanks' from slabs which are of a greater thickness than the buttons are intended to be, and reducing said 'blanks' by pressure to the desired thickness, for the purpose of forming durable and well proportioned buttons."

179. For an *Improved Mortising Machine;* Hiram Plumb, Honesdale, Pennsylvania.

Claim.—"We claim cutting mortises by having two chisels forced gradually into the wood or stuff, and a reciprocating chisel or plane working between. The chisels cutting the ends of the mortise, and the chisel or planer cutting out the wood between them, the above parts being arranged as shown."

180. For an *Improvement in Winnowers of Grain;* B. D. Sanders, Halliday's Cove, Va.

Claim.—"I do not claim the valves or slides for regulating or modifying the blast in the several compartments of the blast spout, nor the spring traps, for they are well known; but I do claim the combination of the inclined screen (next adjoining the feeding hopper,) with the suction spout, subdivided into two or more compartments, the lower ends of the partitions extending downwards nearly to the screen, in the manner set forth."

181. For an *Improved Carriage Axle;* Wm. H. Sanders, Hastings, on Hudson, N. Y.

Claim.—"I do not claim, simply, enlarging an axle at the root, as this has been done; but I do claim the combination of a taper axle, having an enlargement at the root, with a box having a similar inside enlargement at its rear, and a diminution of size outside, provided with concentric rings or grooves for allowing it to be wedged in the hub, the whole being for the purpose of strengthening the axle without enlarging the box, and enabling me to use smaller hubs with a sufficiency of wood therein to preserve the necessary strength, substantially as represented."

182. For *Improved Calipers;* Perley Seaver, Oxford, Massachusetts.

Claim.—"I do not claim the precise form, nor the operating by a screw or springs, or a combination of a screw and spring: but I do claim making the pieces with the projections, when combined with cam B, with its nut, and operating as described."

183. For an *Improvement in Grinding Mills;* Isaac Straub, Cincinnati, Ohio.

Claim.—"I claim the combination of the permanently adjusted tram blocks for supporting the upper stone of the bridge tree, which is adjustable at both its ends, for supporting and adjusting the spindle and the lower stone or runner upon it, to the upper stone, substantially as described."

184. For an *Improvement in Steam Hammers;* Thos. Sumner, Paterson, N. Jersey.

Claim.—"I do not claim merely varying the direction of the blow, and employing for that purpose a hinged or rocking guide frame for the hammer to descend in, with lever to direct the descent; but I do claim the arrangement described, of the hinged guide frame which carries the hammer in relation to the anvil, by supporting the said guide frame on a trunnion below, situated at the back of one side of the anvil, and at the same level, or thereabouts, as that occupied by the bar or works under operation on the anvil; the said hinged guide frame being furnished with a counter-balance weight to facilitate and steady its swing, and relieve the swinging parts from strain when occupying an oblique position, substantially as specified, by which arrangement the hammer may be swiveled from the vertical towards the horizontal position on either side, into radial positions with that portion of the bar or work resting on the centre of the anvil, for the purpose of enabling the hammer to be worked across or around the bar, and to operate alike on its top and corners or sides, to give it a round, taper, or polygonal form in its transverse section, or otherwise work and shape, with convenience and despatch, and whereby the frequent handling or turning of the heavy bar or work is avoided."

185. For *Improved Head Gate for Water Wheels;* H. L. Turner, Strykersville, N. Y.

Claim.—"I claim the manner described, of constructing, arranging, and operating the head gates of re-action water wheels, for the purposes specified."

186. For an *Improvement in Ventilating Sewer;* Enoch Thorn, Philadelphia, Penna.

Claim.—"I claim the application of a self-acting valve to a common sewer, for the purpose of allowing the sewer to relieve itself of the compressed air which at times accumulates in it, so as to prevent the bursting of the sewer, or of its overflow into the streets, substantially as set forth."

187. For an *Improvement in Coffins;* Philo Washburn, Harrison G. O. White, and George A. Copeland, Taunton, Massachusetts.

Claim.—"We claim, 1st, A movable and adaptable head frame, round or otherwise, consisting of the following parts, viz: the head frame, the bar, the uprights, the head cushion, the straps, and the hooks. 2d, The method by which the cover is secured to the coffin, viz: the eyes, the hooks, the eyes and the thumb screws or pins. 3d, The facings of the edges of the lid, and its corresponding aperture with metal, all in the manner substantially as described."

188. For an *Improvement in Constructing Wire Bonnet Frames;* Henry Weed, Philadelphia, Pennsylvania.

Claim.—"I claim the method described, for forming wire framesfor bonnets, viz: by winding the wire round pins or stays, or their equivalents, arranged substantially as described, on a plate or board, thereby securing uniformity and exactness in every particular."

189. For an *Improvement in Whistling Tops;* W. E. Woodbridge, Assignor to Chas. Humphrey, Perth Amboy, New Jersey.

Claim.—"I claim the attachment, substantially as set forth, of a whistle or other instrument capable of producing a musical sound, without regard to the particular form of the top, or the mode in which it is set in motion."

190. For an *Improved Machine for Feeding Paper to Printing Presses;* William F. Collier, Assignor to Wm. F. Collier and Joseph Boyden, Worcester, Massachusetts.

Claim.—"I claim combining with the table (on which the paper is laid) and the sheet lifter, the bar or stand against which the sheet of paper is driven while being lifted from the pack. The object of such bar being to shake the sheet, or produce such a concussion thereon that should two sheets adhere together and be lifted, they may be shaken apart, so that while the upper one is further raised upwards, the lower one may be set free, so as to drop back upon the pack. Also, the combining with the lifter the sheet elevator, by which the sheet of paper is elevated or kept elevated, and deposited on the top of said lifter. Also, the combining with the rotary lifter, the projecting wing, lip, or plate, by which the sheet of paper is raised and presented to or upon the inclined planes or rests of the transferrer, as specified. Also, the transferrer, in combination with the exhausting lifter and the inclined rails, the same being employed to receive and transfer a sheet of paper from its place of deposit on the rails to the press rollers. Also, the mode of opening, holding open, and closing the jaws of the transferrer, viz: by means of the trigger catch lever, the two stops, and the spring applied to the upper jaw. Also, the movable sheet receder, in combination with the inclined rests, and mechanism, substantially as described, for elevating a sheet from the pack, and transferring it to the press rollers. And, also, The combining with the sliding or movable table on which the pile or pack of paper is deposited, mechanism for permitting it not only to fall or move towards the sheet lifter while the upper sheet of the pile is raised above the lifters, but to hold the table firmly in position while the sheet lifter is being moved away from it, or the pile of paper on it, as before stated."

191. For a *Process of Engraving or Printing upon Glass;* Milton D. and Lyman W. Whipple, Assignors to Lyman W. Whipple and Robert B. Fitts, Somerville, Mass.

Claim.—"We claim the within described method of engraving or lettering upon glass, an engraved metallic surface being caused to revolve or vibrate in contact with the surface of the glass, emery or other suitable cutting material being interposed between the bearing surfaces of the two. 2d, The method of causing the engraving cylinder to roll in contact with the surface of the article to be engraved, the parts which carry and give motion to the cylinder being connected with the vibrating lever, operated in the manner substantially as set forth."

192. For *Powder Channel to Doors of Safes and Bank Vaults;* F. C. Goffin, City of New York, Assignor to Alfred B. Ely, Boston, Massachusetts.

Claim.—"I claim the construction of channels or hollow chambers in connexion with

the doors of safes, vaults, &c., the same being open at top and bottom, and reaching from the lock to the bottom of the door, substantially as set forth."

193. For an *Improvement in Machines for Moulding for Metal Casting;* David Brown, Assignor to John F. Clark, Washington, D. C., and David Brown, Baltimore, Md.

Claim.—"I claim the arrangement of the pattern and piston plate surrounding the pattern, within a chamber or piston box, in relation to the half-flasks, operated on in the manner substantially as described, by which I am enablad to protrude the sand into the half-flask from said piston box or chamber, and around the pattern, and thus effect a compression of the sand at the parting, instead of at the central portion of the mould, (as has heretofore been done,) for the purpose of producing more perfect castings."

194. For an *Improved Pump;* Ira Carter, Champlain, New York.

Claim.—"I claim, 1st, The mode of attaching the lug described, made to the cylinder and the groove to contain the packing. 2d, The form and operation of the inducting valves being housed in by the lug of the cylinder, inclosing an air chamber between them, and closing the port holes on a circle section against the water after it passes them, thereby obviating lost suction. 3d, The form and principle of the core, which may be made a stationary part in a pump, or an operative part, by changing the locality of the induction valves only. And, 4th, The mode of oscillating by two cranks with friction wheels on their wrists being brought to act upon one lever between them, vertically attached to that part of the pump to be operated, said cranks being made firm on two parallel horizontal shafts, geared to revolve equal speed and gathering at the top."

195. For an *Improvement in Milk and other Evaporators;* A. F. Dalson, City of N. Y.

Claim.—"I claim the combination of the shallow pan with a rapid current of air underneath the cover, and thence through the central draft pipe, together with the apparatus for continual stirring, by means of the revolving cover and fixtures, substantially as described."

196. For an *Improvement in the Preparation of Archil;* Jonas Eberhardt, Philadelphia, Pennsylvania.

Claim.—"I claim the production of a bright and clear steam purple, without the use of any acid, after its being printed and steamed, as described."

197. For an *Improvement in Smut Machines;* Henry B. James, Trenton, N. Jersey.

Claim.—"I do not claim, separately, the parts specified; but I do claim the combination of the hopper, tank, spiral passage, and separator, effected by means of a common air-tight casing, in the manner set forth."

198. For an *Improvement in Heel Cutters;* Alfred D. Kelley, Rochester, New York; ante-dated March 20, 1854.

"I am aware that spring knives have been used in sole cutters, and that they have had screws adapted to them in such way as to change their form or forms according to the size of the sole to be cut by them; I therefore do not claim such; but I do claim the combination and arrangement of the flexible yoke, and its screw, with the spring blade, for the former or pattern, such flexible yoke and screw enabling a person to change the form of the cutting edge of the knife, or to adapt the knife to any pattern block, substantially as specified."

199. For an *Improved Magazine, Repeating, and Needle Gun;* Edward Lindner, City of New York.

Claim.—"1st, I do not claim the barrel containing the charges, but I claim the application of the rack situated between the gun barrel and the cartridge barrel, and the construction of the piston, in connexion with the said rack, for the purpose of pressing the cartridges into the revolving breech piece, substantially as described. 2d, I do not claim the needle for the purpose of igniting the priming; but I claim the spiral spring round the needle, together with the toggle joint at the upper end of the hammer, constructed as set forth, and acting upon the needle in such a manner that after said toggle joint has pressed the needle sufficiently far into the cartridge to ignite the priming, said toggle joint is forced upwards, allowing, thereby, the needle to spring suddenly back, and pass under the toggle joint by the action of the above mentioned spring, and by which quick retaining motion any heating of the needle is prevented. 3d, I do not claim the revolving breech piece with spiral grooves on the outside circumference; but I claim the arrange-

ment and manner of working the pin, by which the revolving breech piece is made to turn, substantially as described. 4th, I claim covering the bottom of the cartridges with a thin skin, to facilitate the piercing process of the same. 5th. I claim the ramming hammer, worked in the manner and for the purpose herein set forth."

200. For an *Improvement in Breech Loading Fire Arms;* Abner N. Newton, Richmond, Indiana.

Claim.—"I claim, 1st, The method of operating the sliding breech pin by means of the lever, the thumb lever, and the spring, all applied or attached to the arbor which forms the tumbler shaft, and operating substantially as set forth. 2d, Locking and unlocking the sliding breech pin by means of a locking piece which slides in grooves in the stock or shank of the gun, and a lever having a stud working freely in a slot of suitable form, in a plate attached to the same arbor as the levers, by which the breech pin is operated, the whole being arranged substantially as set forth. 3, Fitting the cock and tumbler, or other equivalents usually secured to the tumbler shaft, loosely to the said shaft, within the stock or shank of the piece, and causing the cock to be driven back to cock the piece, by means of a pin attached to the lever, by which the sliding breech is moved back and forth, whereby the sliding breech is allowed to return after the cartridge is introduced, and leave the piece cocked."

201. For an *Improvement in Combing Cotton and other Fibrous Material;* J. Noble, Leeds, England.

Claim.—"I claim, for the purpose of operating upon fibrous material, in the manner as set forth, and in combination with brushes and draw rollers, or their equivalents, the combining of two rotating rings of teeth, so that not only shall one rotate in and be eccentric to the other, but so that at or near one point of the revolutions of the two rings they shall come nearly or quite together, or in contact with each other, substantially as specified; such rings, by their co-operation in the manner set forth, being made to separate the long from the short fibres of the material, when subjected to the action, as explained."

202. For a *Ventilated Flour Barrel;* Thomas Pearsall, Smithboro', New York.

Claim.—"I claim the manner described of preventing fermentation of flour, meal, or other vegetable commodity, by dividing the bulk by means of air pipes or passages, arranged to run through the cask, whereby the flour is prevented from heating and becoming sour at the centre of the cask by the free circulation of the cold atmosphere or air through said tube."

203. For an *Improvement in Ploughs;* Jacob Revercomb, Botetourt, Virginia.

Claim.—"I claim the mode of fastening the points, the same consisting in the insertion of the key through an opening in the land side, in combination with a slot so placed in the stem of such points, that in the different or reversed position of the points, the slot shall be in place for the reception of the key."

204. For an *Improvement in Cordage Machinery;* Philos B. Tyler, Springfield, Mass.

Claim.—"I claim the regulator, substantially as described, wherein the tension of the strand so acts upon a friction brake as to make a uniform resistance, and consequently a uniform tension of the strand or thread."

205. For an *Improvement in Kerosene Burning Fluids;* Abraham Gesner, Williamsburgh, New York, Assignor to the Asphalte Mining and Kerosene Gas Company, City of New York.

Claim.—"Having claimed, under separate specifications, the B and C Kerosene, in this, I claim as a new manufacture or composition of matter for illuminating and other purposes, the liquid hydro-carbon herein described, which I denominate 'A Kerosene.'"

206. For an *Improvement in Kerosene Burning Fluids;* Abraham Gesner, Williamsburgh, New York, Assignor to the Asphalte Mining and Kerosene Gas Company, City of New York.

Claim.—"Having claimed, under separate specifications, the A and B Kerosene, in this, I claim as a new manufacture, the composition of matter for illuminating and other purposes, the liquid hydro-carbon herein described, which I denominate 'C Kerosene.'"

207. For an *Improvement in Kerosene Burning Fluids;* Abraham Gesner, Williamsburgh, New York, Assignor to the Asphalte Mining and Kerosene Gas Company, City of New York.

Claim.—"Having claimed, under separate specifications, the A and C Kerosene, in this, I claim as a new manufacture or composition of matter for illuminating and other purposes, the liquid hydro-carbon herein described, which I denominate 'B Kerosene.'"

RE-ISSUES FOR JUNE, 1854.

1. For an *Improvement in Drying Grain;* Henry G. Bulkley, Kalamazoo, Michigan; patent dated March 2d, 1852; re-issue dated June 27, 1854.

Claim.—"I claim the method of seasoning or kiln drying substances, by using steam in a vessel which has an opening communicating with the atmosphere to limit the pressure, for the purpose of transmitting caloric to the substances to be seasoned or kiln dried, or the vessel or vessels containing them."

2. For an *Improvement in Sewing Machines;* I. M. Singer and Edmund Clark, City of New York, Assignees of Charles Morey and Joseph B. Johnson, Boston, Mass.; patent dated February 6, 1849; re-issue dated June 27, 1854.

Claim.—"We are aware that an adjustable bar has been made use of to hold the cloth to the bar, and prevent it from being retracted by the withdrawal of the needle, and we therefore lay claim to no such device; but what we do claim is, the spring or curved arm for the purpose of holding the cloth to the surface of the feeding apparatus by a yielding pressure, in the manner set forth."

3. For an *Improvement in the Mode of Dressing Mill Stones;* Elisha S. Snyder, Charlestown, Virginia; patent dated Feb. 10, 1840; re-issue dated June 20, 1854.

Claim.—"I claim the mode of dressing mill stones in ridges and furrows, and also in furrows and lands tangential to the eye, each furrow and land gradually increasing in width, and the furrows in depth, from the eye to the circumference, being of a triangular shape in its vertical cross-section, and every alternate ridge or land being omitted from the eye to the circle forming large triangular cavities for the admission of the grain to be broken preparatory to its passing to the long furrows to be ground into flour. Also, the form of dress for mill stones, either for the ridges, or the lands, or the furrows, separately, or, as combined as above described, in ridges and furrows, or in lands and furrows. I do not claim ridges, or lands, or furrows, these being old devices in mill stone dressing; but I claim the tangent form or shape given to the ridges, and lands, and furrows."

DESIGN FOR JUNE, 1854.

1. For *Cooking Stoves;* Apollos Richmond, Assignor to A. C. Barstow & Co., Providence, Rhode Island; dated June 13, 1854.

Claim.—"I claim the music staff, raised figures, and ornamental configurations, for the side and front plates."

JULY 4.

1. For an *Improvement in Potato Diggers;* Galusha Jonas Bundy, Lynden, Vermont.

Claim.—"The inclined fingers, in combination with a scoop, have been heretofore employed in a machine for digging potatoes, and to such fingers a vibratory motion has been imparted, in order to separate and discharge the earth, the earth being made to drop through the spaces between the teeth or fingers, whilst the potatoes are forced up the inclined plane formed by the fingers, and for the purpose of loosening the ground or reducing its surface to a finer state than it was previously, there is nothing new in employing on a mould board a horizontal plate and vertical cutters, extending upward from two to three inches therefrom; I therefore do not claim any such inventions; but I claim my improvement in the construction of the mould boards of a potato plough, or the making them with slots or passages standing vertically or nearly so, and having their respective planes parallel to a vertical plane passing through the draft beam of the machine."

2. For an *Improvement in the Construction of Salt Evaporators;* Henry G. Bulkley, Kalamazoo, Michigan.

Claim.—"I claim the employment for boiling salt, or for any evaporating process of a similar nature, of a series of pans arranged in communication with each other, and heated by a pipe or flue passing through them in succession, so as to heat the brine, or other solution, and cause the deposit of the impurities previously to its entering the pan in which the crystallization or final boiling takes place."

3. For an *Improvement in Screw Wrenches;* Ary G. Coes, Worcester, Mass.

Claim.—"I claim the arrangement of the elevating screw (made as a male screw,) of the tube, in the external surface of the tube, and so as to extend below the milled head and the screw, in combination with the arrangement of the screw (made as a female screw) within a socket tube on the handle."

4. For an *Improved Machine for Bending Felloes;* Thomas Cox, Lancaster, Penna.

Claim.—"I claim the combination of the vibrating felly mould with the flanched bending wheel, arranged as described. Also, the manner of perfectly bending the last end of each felly, and securing it, when completely bent, upon the mould, viz: by the combined action of the bending wheel, and of the wedge clamp."

5. For *Improved Mechanism for Operating Saw Mill Carriages;* A. S. T. Copeland, Pittsburgh, Pennsylvania.

Claim.—"I claim the combination of the triangularly working shaft, the mechanism for shifting it into and out of gear, with the right and left handle endless screws, in any manner substantially the same as described."

6. For an *Improved Machine for Creasing and Beveling Barrels;* Archibald H. Crozier, Oswego, New York.

Claim.—"I claim the movable platform and movable cutters, arranged so that the cutters may be moved from the barrel, and free from the crease when the platform and barrel descend, and moved towards the barrel when the platform and barrel are raised."

7. For an *Improvement in Sofas, Crib Bedsteads, &c.;* T. W. Currier, Lawrence, Mass.

Claim.—"I claim the combined arrrangement of the cam wheels and the rockers carried by the cam wheels, whereby, by rotating the cam wheels, the chair or sofa can be raised or lowered at pleasure, and also the rockers brought into play when desired."

8. For an *Improvement in the Preparation of Collodion for Photographic Pictures;* James A. Cutting, Boston, Massachusetts.

"The nature of my invention consists in the use of gum camphor in addition to the existing materials, in the preparation of collodion for positive photographic pictures on glass."

Claim.—"I claim the use of camphor, in combination with iodized collodion, as set forth."

9. For an *Improvement in Finishing Palm Leaf Hats;* Dexter Dennis, Barre, Mass.; ante-dated January 4, 1854.

Claim.—"I claim the covering the outer surface of the hat holder with the stiffening composition, and applying the hat thereon, and subjecting it to the action of the heating flats. Also, the combination of the round corner flat with the crown and side flats, so as to operate in connexion with them, as specified. Also, using a hat holder, elliptical or oval, in its horizontal section, in combination with applying to the side flat a spring bar or contrivances that will allow it to spring or move while the hat holder is revolved, and adapt itself to such hat holder, as specified. I claim, in combination with the top or crown flat and the elevating and depressing machinery thereof, a fan apparatus, to regulate its downward descent on the hat. And, in combination with the frame and the crown flat, the toggles and levers, and the projection, the springs and connecting cords, the whole being to enable the frame and the top or crown flat to be operated, substantially as specified."

10. For an *Improved Valve for Wind Musical Instruments;* C. H. Eisenbrandt, Baltimore, Maryland.

Claim.—"I claim arranging the rotating valve on a pivot axis, the extremities thereof pointed, or arranged so as to work in the ends of an adjusting screw passing through an

elbow support attached to the cap of the air chamber, and the end working in a tightening screw rest; the said valve axis attached to a rotating double jointed lever device, combined with the finger plate; the said pivot axis rotating valve device being used in combination with a common sewing needle spring, or its equivalent, passing through the yoke or lever rest, the end or point of the spring resting on the upper side of a projection or spur. The whole claimed as a combination, whereby a perfect trill or shake can be produced, and the same modulated so as to readily afford the crescendo and decrescendo effect, which has never heretofore been accomplished in the valves of brass wind musical instruments. I do not confine myself to any particular construction of lever, combined with the common needle spring, or its equivalent, to produce the new and important effect."

11. For *Mill Stone Dress;* William Finkley, Cole Creek, Indiana.

Claim.—"I claim the skirt furrow, isolated both from the leading and from the intermediate furrow or furrows, for the objects before stated, but parallel to the succeeding leader, in order to facilitate the delivery of the meal as it is ground, either in connexion, or otherwise, with the flared and deepened entrances of the leading furrows, as described."

12. For an *Improvement in Lightning Rods for Vessels;* R. B. Forbes, Boston, Mass.

Claim.—"I do not claim the system of permanent conductors as applied to the mast of a vessel, in the manner well known as that of Sir William Snow Harris, wherein the conductor is carried down the mast, and through the hold and keel of the vessel; nor do I claim either the common chain or rod conductor, nor the mode or modes of applying the same; nor do I claim to make the conductor of fixed lines of metal, and to extend down the mast to near the lower mast head, and from thence down the after swifters to the ship's side; nor do I claim to make that part of the conductor extending down on the after swifter or shroud, as one long tube of metal; but what I do claim is, composing it of a system of socket tubes and slide tubes, and confining the same to one of the shrouds or the rigging, and over and against the outside of the hull, and either to the copper sheathing thereon, or down to such a depth on the hull that the lower end of the conductor shall always remain immersed in the water under the ordinary rolling or pitching of the vessel while at sea, all substantially as specified."

13. For a *Sub-Marine Battery;* Joseph Frey and D. B. Burnham, Battle Creek, Mich.

Claim.—"We claim our arrangement of guns in the hull of a boat under water, with port holes and gates, in such a manner as the guns may be loaded and fired at pleasure."

14. For an *Improvement in Quartz Crushers;* Heman Gardiner, City of New York.

Claim.—"I claim, 1st, Suspending the basin at the centre by a fixed shaft above a bed, whereby, while every part of its circumference is in turn depressed by an arm and roller, or their equivalents, revolving on the shaft, the lowest part of the basin where the greatest weight is, always rests upon the bed, and the shaft is relieved of the greater portion of the weight of the basin and its contents. 2d, The supplemental ball, suspended or attached from the pulley, or its equivalent, revolving above the basin, so that it is always in contact with the inclined part of the basin where the quartz or ore is most thinly distributed."

15. For an *Improvement in Steam Boilers;* Thomas Greer, Philadelphia, Penna.

Claim.—"I claim a series of angular tubes, arranged and for the purpose as specified."

16. For an *Improvement in Milk Strainers;* Joel Gleason, Geneva, New York.

Claim.—"I claim the combination of the packing with the hinged catches, the strainer being supported on the pail by means of the packing, in combination with the catches, and the packing being fixed to the body of the strainer by locking the tin on to the packing on the underside of the body of the strainer."

17. For *Improved Machinery for Punching Rivet Holes in Hose;* John R. Hague, Pittsburgh, Pennsylvania.

Claim.—"I claim the use of the sliding table and the pressing board, in combination with the rack work, the lever, and the finger, for the purpose of moving forward the leather on the sliding table during each stroke of the punching gate, and in combination with the punching gate and punches."

18. For an *Improvement for Regulating the Motion of Steam Engines;* William C. Hibbard, Boston, Massachusetts.

Claim.—"I claim the 'isochronal eccentric,' substantially as described, as a device to

be used in machines for moving steam valves, or for other similar purposes. Also, the combination of the isochronal eccentric with a governor or regulator, in such a manner that the governor or regulator shall control the amount of its eccentricity, and thus by the variable movement of the valves, regulate the velocity of the engine."

19. For an *Improvement in Reading and Writing Stands;* E. Hidden, City of N. Y.

Claim.—"I claim, 1st, The combination of the double jointed bracket and screw for adjusting the position of the desk, both horizontally and vertically, as set forth. 2d, The application of the sliding clasps with an india rubber or other elastic band for securing books, papers, &c., in the position desired, as set forth. 3d, The mode described, of fixing the bracket, supporting the lamp or candle holder, admitting of adjustment at every angle the desk may be placed in."

20. For an *Improvement in Spike Machines;* Fenton Humphrey, Boontown, N. J.

Claim.—"I claim, 1st, The manner of pointing, by which I obtain a change in the place of labor on the rollers at every revolution. 2d, The general construction, arrangement, and combination of the levers, for the specified purposes."

21. For an *Improvement in Seed Planters;* Samuel Ide, East Shelby, New York.

Claim.—"I claim the series of connected chambers or recesses around the centre of the rotating cog wheel, whereby a uniform and continuous distribution of the seed is effected."

22. For an *Improved Catch for Vault Covers;* J. K. Ingalls, Williamsburgh, N. York.

Claim.—"I claim the additional lip or nose, with the recess, for the eye of the cover to fit into and hold the catch, unlocked, as arranged in relation to the other parts of the catch or lock, and operated as set forth."

23. For an *Improvement in Washboards;* Philip H. Keck, Morgantown, Virginia.

Claim.—"I claim the construction of the washboard, with the chamber and closely fitting slide, in combination with the channel and openings, for furnishing a constant supply of water to the clothes."

24. For an *Improvement in Ore Stamping Machines;* J. F. Laird, Philadelphia, Pa.

Claim.—"I claim the arrangement of the lifters by being so placed as to operate on the periphery of the tappet head, for the purpose of giving the stampers a partial rotation without requiring other mechanism."

25. For an *Improvement in Controlling Draft in Brick and Lime Kilns;* J. Leeds, Philadelphia, Pennsylvania.

Claim.—"I claim controlling or regulating the draft of lime, brick, or other kilns, by means of a double dome, in the under one of which the openings are at its outer edge, and in the centre of the upper one, so as to force the draft from the centre to the outside of the kiln. Also, in combination with kilns controlled by the double domes, the main or auxiliary chimney for increasing the draft in the kiln."

26. For an *Improvement in Paddle Wheels;* Wm. H. Muntz, Norton, Mass.

Claim.—"I claim attaching each of the said paddles or floats to wheels or rims, wherein that to which the broad surface of each of the paddles is attached, is of greater diameter than the other, and the position of the paddle is in or about in a line parallel to a radial line, or one drawn through the centre of the wheel shaft, and the face of the paddle is oblique to the plane of this line, which stands perpendicularly to the axis of the shaft."

27. For an *Improvement in Horse Powers;* John A. Pitts, Buffalo, New York.

Claim.—"I claim the boss and set screws, in combination with the bridge-piece, for the purpose of adjusting the spur gear and bevel wheels to the main driving wheel, to prevent binding or cutting, as described."

28. For an *Improvement in Cast Iron Car Wheels;* Benj. Severson, Philadelphia, Pa.

Claim—"I do not claim any part of the rim nor hub, nor connecting them with a solid web; neither do I claim common corrugations nor brackets; but what I do claim is, a cast iron web deeply corrugated where it joints to the rim, with the corrugations gradually lessening in depth as they approach towards the centre of the wheel, so as to wholly disappear at or near the hub, when it is used for the purpose of uniting a rim and hub, and has its central part strengthened by means of brackets."

29. For an *Improvement in Brick Kilns;* John S. Speights, Baltimore, Maryland.

Claim.—"I do not claim constructing the kiln with air passages between the fire beds; but I claim the long grates with air passages which extend clear through the kiln below them, and have doors to admit the air at either or both ends, in combination with small air passages between them, having lateral openings to throw the air under the middle of the fire, for the purpose of regulating the admission of the air to any part of any grate or every grate, so as to regulate the combustion, and thereby regulate the heat in all parts of the kiln."

30. For an *Improved Beveling Plane;* M. J. Wheeler, G. W. Rogers, H. W. Pierce, and M. B. Tidy, Dundee, New York.

Claim.—"We claim attaching the two bevel cutters to two rings which are hinged by a three-flanched hinge, or otherwise so secured to the body of the plane as to be capable of swinging a certain distance around a common pivot or axis, for the purpose of being adjusted to set their faces and the edges of their cutters at any angle to each other, and to the face of the fence."

31. For an *Improved Mode of Hanging Bells;* Jerome B. Young, Harper's Ferry, Va.

Claim.—"I claim the construction of a bell, having attached thereto an arm formed on a tube, having working through it an actuating lever, combined with a gravitating piston striker working through a barrel or socket attached to the elbow and arm; the whole used together with the tympanum, and combined in its application with the door of a dwelling, or otherwise."

32. For an *Improvement in Cement Compounds;* Wm. H. Poindexter, Fayette County, Tennessee, Administrator of John S. Remington, deceased, late of Macon County, Alabama.

Claim.—"What is claimed is, the use of cotton seed ashes, or the ashes of any other oil yielding vegetable substance, as an ingredient of a cement, substantially as set forth, whether it be mixed with rosin and earthy matters, or with oil and earthy matter."

33. For an *Improvement in Knitting Machines;* Henry Burt, Assignor to Newark Patent Hosiery Company, Newark, New Jersey.

Claim.—"I claim, 1st, The hollow bar, or its equivalent, in combination with the extended ends of the sinkers, for the purpose described. 2d, The radius bar, constructed and operating as described, in combination with the cylinder and the collar."

34. For an *Improvement in Purifying Oils;* Thos. Drayton, Brooklyn, Assignor to G. W. M'Cready, City of New York.

Claim.—"I claim the mode or process of using the above purifying oils, and producing a burning fluid."

35. For an *Improvement in Sewing Machines;* Wm. Butterfield, Assignor to himself and Edgar M. Stevens, Boston, Massachusetts.

Claim.—"I do not claim the combination of a needle slide and hooked needle, wherein the slide is made to operate so as to close or cover the hook, and prevent it from catching in the fabric while it is being drawn through the same; nor do I claim any arrangement of applying the closing slide of a hooked needle to the same side of a needle as is the barb or hook, so that such slide may slide in a groove in the needle (or carrier thereof) parallel to the motion of the needle; but what I do claim in the chain stitch sewing machine, operating with a hooked needle. or hook to draw the thread through the material to be sewed, is the 'rest cast-off,' in its combination with the hooked needle, and as applied to and made to operate with it and the material to be sewed, and in the loop of thread. Also, the improvement by which the rest cast-off is rendered capable of adapting itself to any ordinary thickness or variation of thickness of the fabric or article to be sewed; such improvement consisting in the described mode of operating it by the spring applied to the carrier lever, and made to operate on the lower end of the recess. I do not claim the application of a spring to the bobbin for the purpose of enabling the bobbin to fall or turn backward, and to take up the slack of the thread; but what I do claim is, the combination of the bobbin holder with the spring, the friction disk, and the axle on which the holder turns, the same enabling an empty bobbin to be removed from the holder, and a full one put in its place, without disturbing the connexion of the spring with the bobbin and friction plate or disk."

36. For an *Improvement in Self-Acting Cheese Presses;* Solomon W. Ruggles, Assignor to himself, Artemus R. Smith, and J. O. Austin, Fitchburgh, Massachusetts.

Claim.—"I claim the general construction and application of the pressing power or mechanism, or the arrangement of the pressure bars or struts, and the arms or pitman, and their application to the remaining stationary and movable parts of the press, whereby the press is made to operate in manner as explained, and to great advantage and power, and with little friction, and is reduced to a very desirable and compact form."

37. For an *Improved Machine for Excavating Earth;* John Taggart, Roxbury, Assignor to himself and Richard Pitts, Dorchester, Massachusetts.

Claim.—"I claim the combination of the gravitating weight and its line with the windlass barrel and the brake wheel, so as to operate automatically, and rotate both windlass and brake wheel, and not only take up the slack of the rope while the scoops are being elevated, but at the same time to set the brake wheel ready for the action of the brake, when it becomes necessary to drop the scoops in order to discharge their load. I do not claim the employment of a single line and two branch lines applied respectively to the two scoop levers, and independently of their boom; but I claim the arrangement of the branch lines of the line, so as not only to operate through the ends of the scoop levers, but also through guiding or sheave passages of the boom, such an arrangement of the branch lines producing an increase of draft on the scoop levers during the operation of closing them. I also claim, in combination with the afore-described arrangement of the line, through the sheave openings of the boom, and the two scoop levers, or about their sheaves, the union of the branches into one line, in connexion with the carrying such line through a compensating passage of the boom, and permitting it to slide freely through the same, in manner as described, the same being for the purpose of enabling the scoops to close together or upon an object whenever the movement of one of them during the operation of closing them together is arrested by contact with an obstacle, as explained. I am aware that a single scoop has been applied to a boom, and that boom made to slide through a slotted horizontal rocker shaft projected over the side of a screw. Also, that double scoops have been applied to a boom or an upright frame made to have vertical movements, and to work through a derrick or platform. I do not, therefore, claim any such applications of a boom of a single scoop, or the supporters of a set of scoops; neither do I claim the combination of a rocker tube or eye with a rocker frame, as described, and for the purpose of obtaining a compound movement; but I do claim the combining the boom and the working ropes of it and its scoops with a crane, substantially as specified, so that the scoops may be free to be moved not only vertically, but also in any direction, either towards or away from, or laterally with respect to the crane and its platform, whereby, while the scoops are grasping a stump, or other article adhering to the mud or earth, a lateral movement of the crane may be employed to effect leverage on the scoops in a lateral direction, so as to aid in disengaging the stump or article grasped by the scoops, and to effect this without injurious strain on the boom, or the parts through which the boom slides."

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38. For an *Improvement in Making Wrought Iron Car Wheels;* George B. Hartson, City of New York.

Claim.—"I claim the converging or centripetal pressure rolls, arranged and operating to form a tread or rim on the outer margin of a thin disk of metal, by thickening the said margin, and moulding it into the required shape, whether the sides of the disk within the rim be supported by clamp rolls or not, and also whether the disk be heated simultaneously with the compression or not."

39. For a *Gas Heating Apparatus;* Charles M. Guild, Brooklyn, New York.

Claim.—"I claim the opening and closing of the valve which admits the gas to the heating apparatus by the act of placing and removing the vessel or thing to be heated. Also, the small perforations leading from the gas pipe to the burner or heating apparatus, acting independently of the valve, for the purpose of admitting a jet of gas, barely sufficient to keep up the flame, without unnecessary consumption of gas, when the heater is not in immediate use, or when one article is removed, and before another takes its place."

40. For a *Coal Sifter;* Elisha French, Braintree, Massachusetts.

Claim.—"I claim a coal screen in a box fitted with a sliding top and ends, and with rockers placed at right angles to each other on the bottom."

41. For an *Improved Slide Valve Motion for Steam Engines;* Martin V. B. Darling, Providence, Rhode Island.

Claim.—"I claim, 1st, Combining the cam and yoke motion for opening the steam port, and the eccentric or cam and yoke motion for closing the steam port, and causing the two motions to act on the valve, by connecting with the valve the yoke rod of the cam and yoke motion, which gives the movement for opening the port, and furnishing the rod of the eccentric or cam motion, which gives the movement for closing the valve, with an eye, or its equivalent, which plays between two stops or tappet pieces properly arranged on the rod. 2d, Giving to the eccentric or cam which gives the movement to close the valve a greater throw than the cam which opens the valve, in order that at the proper time the valve may be made to close the steam port and cut off the steam very quickly, or by a very small part of the revolution of the main shaft."

42. For an *Improvement in Camphor Wash Mixtures;* C. W. Crozier, Knoxville, Tenn.

Claim.—"I claim the combination of the several ingredients with camphor, without the latter substance; the only ingredient that contains the qualities of an essential or volatile oil would be the turpentine. By the addition of the camphor, we have the peculiar qualities of the oil increased. 'Volatile oil occurs in every part of odoriferous plants.' (Ure's Dictionary.) 'Berzelius considers camphor a stearoplene,' (U. S. Dispensatory, page 155.) Stearoplene, or stearine, having the same import, is the solid constituent of fatty substances, as of tallow and olive oil, converted into a crystalline mass by saponification with alkaline matter, (Ure's Dictionary.) Fatty matters, when subjected to the action of alkaline leys, undergo a remarkable change, being converted into three different acids, called stearic, margaric, and oleic, (Ure's Dictionary, page 1148.) Soap, in the most extended signification of the term, embraces all those compounds which result from the reaction of salifiable bases in oils and fats. These consist of three principles, two solid, differing in fusibility, called stearine and margarin, and one liquid, called olein, of which there are two varieties; stearine characterizes the fats which are firm and solid, as tallow, &c. From these facts, there is no doubt of the saponaceous qualities of the camphor, and its power as a detergent, and that it is a very important and valuable addition to the wash mixture."

43. For an *Improved Arrangement for Mooring and Managing Balloons;* John W. Brewer, Cincinnati, Ohio.

Claim.—"I claim the plan of building, and the arrangement of the necessary machinery, together with a stationary steam engine, gas generators, &c., therein set forth, for mooring and managing balloons."

44. For an *Improvement in Harvester Rakes;* Collins Brown, Upper Alton, Illinois.

Claim.—"I claim imparting the required movements to the rake, by combining with its handle the horizontally vibrating fulcrum lever, and the outer end of the lever, which has a compound vertical and horizontal movement imparted to it by means of the crank pin, pivot, nut, and the curved slotted inner portion of said lever."

45. For an *Improved Implement for Blasting Rocks;* C. F. Brown, Warren, R. I.

Claim.—"I claim blasting rocks by placing the powder or charge within a tube or case, and between two heads attached or connected to a rod, and provided with suitable packing, one of said heads being movable upon the rod, and secured at the desired point by a nut or its equivalent, the tube or case being inserted in a hole or aperture drilled in the rock, the diameter of which corresponds to that of the tube or case."

46. For an *Improvement in Foundations for Pavements;* J. B. Wickersham, City of N. Y.

Claim.—"I claim the employment, as a foundation for pavements, of a lay of woven, or interlaced, or other iron work, laid upon a bed of any suitable material, substantially as described."

47. For an *Improvement in Parallel Motion of Beam Engines;* John M. Thompson, Taunton, Massachusetts.

Claim.—"I claim producing a parallel motion by connecting the link to one end of a radius rod, whose other end is attached to a crank or arm on a rock shaft placed under the centre of the beam, and receiving a motion from the same by gearing."

48. For a *Machine for Mortising Sash Stiles;* J. B. Smith, Milwaukie, Wisconsin.

Claim.—"I claim the arrangement of the parts so as to constitute a machine capable

of mortising both ends of sash stiles of any desired length, and cleaning out the mortises simultaneous with their completion, without the necessity of reversing the ends of the stiles, or tightening or slackening the driving belt. Also, the combination and arrangement of the vertical power chisels and the stationary chisels with the movable bed and sliding carriage, or their equivalents, independent of the arrangement of the driving belt, when used for mortising sash stiles of only one length, and cleaning out the mortises."

49. For an *Improvement in Trap Doors;* Gustavus Runge, Philadelphia, Penna.

Claim.—"I claim the application to trap doors of hatchways of counterbalances, hidden from view, working between the flooring and ceiling, substantially as specified, and the attachment of the hinges to the under side of the trap door, to avoid all obstructions on the top of the same, and making one smooth surface with the flooring above, as shown and described."

50. For a *Method of Applying Water to Compound Buckets of Flutter Wheels;* David Rankin, Augusta County, Virginia.

Claim.—"I claim the so arranging of cuneiform buckets upon the radial arms of flutter wheels, so that in passing through an eccentrically formed water way, three buckets shall receive the volume of water, in about the proportions described."

51. For *Improvements in Plating Metals;* Robert G. Pine, Newark, N. J.

Claim.—"I claim plating articles, by fitting said articles within a female die formed by thin sheet metal, or any other material, which is placed upon an elastic bed, the foil and solder being placed between the female die and article, and forcing a male die in a heated state upon the article, for the purpose of fusing the solder and causing the foil to adhere and become firmly united to the article, as set forth."

52. For an *Improved Sawing Machine;* Charles F. Hackard, Greenwich, Conn.

Claim.—"I claim the combination of the vertical circular saw, or a vertical reciprocating saw, and the horizontal saws, when said saws are constructed in the manner shown."

53. For an *Improvement in Horse Powers;* William M'Cord, Sing Sing, N. York.

Claim.—"I claim the precise manner of combining the parts specified, so as to produce an anti-friction horse power."

54. For an *Improvement in Gas Stoves;* Andrew Mayer, Philadelphia, Penna.

Claim.—"I do not claim the perforated distributing disk, for that has been employed; nor placing pummice stone or other incombustible material in the frame for retaining the heat, for that is well known; but I claim the arrangement of the tube, hot air chamber, and disks, as described."

55. For an *Improvement in Eyelet Machines;* Hymen S. Lipman, Philadelphia, Pa.

Claim.—"I claim, in combination with a fastener and a reservoir of eyelets, the converging apparatus for carrying the eyelet from one to the other. Also, the threading of the eyelets upon a rod or stem, from which they may be delivered, one at a time, to the carrying apparatus."

56. For an *Improvement in Lightning Rods;* Amos Lyon, Worcester, Mass.

Claim.—"I claim the metallic surface lightning rod, made in the form described, or in any and every form, where sheet copper, sheet brass or iron, (either of which may be coated with metal or not,) and where the surface is all or nearly all exposed to the electrical atmosphere, and is adapted to present points upon its edges throughout its entire length, according to the mode described."

57. For an *Improvement in Apparatus for Detaching Harness from Horses;* Samuel Hunt, Baltimore, Maryland.

Claim.—"I claim uniting the two sections of a saddle tree by a tongue projecting one section and fastened in a corresponding groove in the other, by a metal shaft and spiral spring, the whole being entirely concealed from view. Also, arranging a set of terrets in two sections, each fitting into a dove-tailed groove in the top of the front of one section of the saddle tree."

58. For an *Improvement in Ornamenting Metallic Buttons;* Hiram W. Hayden, Waterbury, Connecticut.

Claim.—"I do not claim combining a series or cluster of bright and deadened punches

in one die, to produce the whole design or figure by one blow of the die, as this has been done. I claim the method of ornamenting metallic buttons and similar articles, by submitting the same to the separate operations of deadened and bright dies, constructed substantially as specified."

59. For an *Improved Mode of Connecting Water Pipes;* Jonathan Ball, City of N. Y.

Claim.—"I claim the cock attached to the metal tube, in combination with the boring tool inserted through the cock, by which the pipe and cement is perforated, in the manner and as specified."

60. For an *Improved Mode of Arranging Arch Boards for Cistern Arches;* H. Crosby, Gustavus, Ohio.

Claim.—"I claim the construction of an arch board of a combination of angular curved segments or sections, secured together by hooks and dowels, or their equivalents, arranged in the manner described; this arch board I claim in its application to the purpose specified."

61. For an *Improvement in Composition for Making Photographic Pictures;* James A. Cutting, Boston, Massachusetts.

Claim.—"I claim, 1st, Displacing the water from the cotton for this purpose, with strong alcohol, as set forth. I do not claim the use of alcohol as a desiccating agent, but limit my claim to its special use and purpose, as herein stated."

62. For an *Improvement in Photographic Pictures on Glass;* James A. Cutting, Boston, Massachusetts.

Claim.—"I am aware of the previous use of balsam for the cementing of lenses, and the securing of microscopic objects, and other like purposes, and do not, therefore, extend my claim to any of these uses; but I claim the combination of balsam with photographic pictures on glass, and with the additional glass, by which they, with the balsam, are hermetically sealed, as described, and for the purposes set forth, and for no other."

63. For an *Improvement in Ventilating Railroad Cars;* G. F. Foote, Buffalo, N. Y.

Claim.—"I claim the arrangement and construction of the apparatus described, or other mode substantially the same, for ventilating a railroad car with purified or heated air, or both, as set forth; and I also claim the diffuser and its equivalents, for the uses and purposes specified."

64. For *Improved Cements of Boiled Coal Tar and Earths;* Henry P. Gengembre, Alleghany City, Pennsylvania.

Claim.—"I claim the process of preparing fusible marble by adding asphaltum or mineral pitch, aluminous clay, calcareous loam, and silex, in or about the following proportions, viz: aluminous clay, 60 to 75 per cent.; calcareous loam, from 10 to 20 per cent.; pitch, from 30 to 40; and silex in quantity sufficient to give the desired hardness. The quantity of pitch to be increased or reduced, according to the temperature or purposes for which the manufactured article is to be used."

65. For an *Improvement in the Construction of Ink Stands;* Robert T. Fry, Philadelphia, Pennsylvania.

Claim.—"I claim a two part inkstand, with the elastic disk secured to the upper part or half; said two parts being held together air tight by a flanched cap or ring, and so that access may be had to the ink reservoir without disturbing or removing from its part the elastic diaphragm."

66. For a *Chair Cane;* Rufus Porter, Washington, District of Columbia.

Claim.—"I claim constructing a chair or table by hinging four arms and four legs to a hub or hubs attached to or mounted upon a central vertical shaft, and supporting said arms and legs by radial braces, which connect said arms and legs to sliding sockets in such a manner that said arms and legs may be closed up to a compact form, as described."

67. For an *Improvement in Diaper Pins;* J. Rabbeth, East Hartford, Connecticut.

Claim.—"I claim the combination of the slotted tube, arranged in the manner set forth."

68. For an *Improvement in Cow Catchers;* Thomas B. Smith, Triune, Tennessee.

Claim.—"I claim the beam or scraper, in combination with the nut piece and screw,

arranged and operating to produce the alternate lateral movement of the beam over the surface of the cow catcher."

69. For an *Improvement in Condensers for Steam Engines;* Franklin G. Smith, Columbia, Tennessee.

Claim.—"(Tubular *condenser* for steam engines.) Whereas, in the operation of the tubular condenser, especially if the attempt be made to work without the injection of cold water, there is much difficulty found in effecting the instantaneous transmission of the caloric of the steam through the metal forming the tube of the condenser, on account of the thickness of the metal necessarily used on the plans heretofore adopted to secure the requisite strength for resisting the force of the atmospheric pressure: I claim the mode of constructing such tubes by which the two offices of assisting the atmospheric pressure, and transmitting the caloric of the steam to the surrounding cold water through the intervening metal of the tubes, are separated; the pressure resisting strength being gained from an interior tube of stiff metal having innumerable holes punched through it, and this being surrounded by a water-tight covering of thin sheet copper, or other suitable material, against the internal face of which the steam impinges by passing through the perforations in the strong inner tube, and is thus brought into the nearest possible contact with the surrounding cold water."

70. For an *Improvement in Machine for Planing Stones and Metals;* Josiah M. Smith, City of New York.

Claim.—"I claim the revolving disk containing a series of cutters, sufficient for completing the planing of a portion of the surface of an object, in combination with the rest or slide."

71. For a *Ship Ventilator;* Willet Thompson, New Haven, Connecticut.

Claim.—"I claim the construction of deck ventilators for ships, the combination and arrangement of the elevating spring with the cap, and its tightening inclines for locking the cap when closed, the whole being constructed and operating, whereby the cap of the ventilator is not only made self-rising and held open by the spring beneath to insure ventilation whilst loading and discharging cargo, without loss of time or labor in opening or closing the ventilator as goods are passed on or over it and the deck, but whereby greater convenience and facility is afforded for rolling or passing casks of goods over the ventilator, by reason of the specified yield or easy depression which the cap is made capable of, when the cask in touching the cap throws part of its weight thereon, and whereby the ventilator is rendered less liable to strainage, injury, or breakage of its stem, or other part, when open, and is more securely locked when closed, and the cap protected from accidental turning or opening, by reason of the upward pressure of the spring causing the locking projection of the cap to bite firmly against the stationary inclines."

72. For an *Improvement in Machines for Hackling Corn Husks;* Wm. H. Fullerton, Louisville, Kentucky.

Claim.—"I claim the particular form of the teeth employed, of whatever material they are made, for the purpose of being arranged in any way, on drums or otherwise, and the particular application of them for the purpose of hackling corn husks."

73. For *Hot Air Furnace;* Peter Sweeny, Buffalo, New York.

Claim.—"I claim making such air supplying apparatus movable and adjustable within the fire-pot or chamber, for the purpose of adapting it to the varying height and condition of the charge of fuel to effect the economical combustion thereof. Also, making such air supplying apparatus in two parts, substantially as specified. And, finally, dividing the hot air chamber into two or more compartments, by partitions provided with apertures governed by dampers or valves, for the purpose of regulating the supply of air to separate the parts of a building, as circumstances may require."

74. For an *Improvement in Self-Acting Mules for Spinning;* George Wright, New England Village, Massachusetts.

Claim.—"I claim, 1st, Driving the carriage in and out by the continuous motion of the cone pulleys, in combination with some method of automatically shifting the belt, for the purpose of adapting the speed of the carriage to the requirements of the different parts of its traverse, by which means I am enabled to dispense with the complicated mechanism heretofore adopted for the attainment of the same end. 2d, The pulleys upon the shaft, by which a continuous motion in one direction is given to the shaft, for

the purpose of driving the carriage, and an intermittent motion to the twist pulley, when the winding on is accomplished by mechanism independent of the motion of the twist pulley. 3d, I claim the friction pulley, or its equivalent, constructed and operating in combination with any efficient method of regulating the speed of the spindles by the tension of the yarns, in the manner set forth, by which means I dispense with the complicated machinery heretofore made use of to regulate the winding on, and am enabled to run my machine at a speed far exceeding that which can be attained where the motions of heavy cogged gearing are to be constantly reversed."

75. For an *Improvement in Augers, Gimlets, &c.;* W. Spangler, Harper's Ferry, Va.

Claim.—"I claim constructing augers and gimlets out of any desired shape of metal, by filing, turning, or in any equivalent manner, or using tapering pieces of metal concave on one or both sides, and forming two bevel cutting edges, or graduated or regularly diminishing conical twists."

76. For an *Improvement in Apparatus for Corking Bottles;* Thomas W. Gillett, New Haven, Connecticut.

Claim.—"I claim combining the safety cylinder or screen with the cross bar of the charging socket, or other proper part of the bottling machine, so that the said screen will surround the bottle at the same time that the charging socket is brought over the neck of the bottle, and keep it there until the filling and corking has been completed."

77. For *Improved Adjustable Bearings for Circular Saws;* Ann G. V. McKinstry, Administratrix and Executrix of Wm. McKinstry, late of Washington, D. C.

Claim.—"I claim the arrangement of the bed plate carrying the boxes, in combination with the set screws, holding bolts, shaft, and circular saw, as set forth."

78. For an *Improvement in Fire Arms;* Eden Baldwin, 2d, Administrator of Eden Baldwin, Worcester, Massachusetts.

Claim.—"A movable loading or slide chamber, and a tubular loading magazine, in combination with the gun barrel, is not herein claimed; but what is claimed is, 1st, The manner in which such movable slide chamber and loading magazine are arranged, combined, and made to operate with respect to one another and the barrel, whereby a series of charges or cartridges are successfully carried from the magazine to the barrel by one sliding chamber only. 2d, And, in combination with the depressing chamber or slide, and the tubular or loading magazine, I claim mechanism substantially as described, for moving the cartridges into the depressing chamber when depressed into line with the loading magazine. 3d, And, in combination with the slide and the lever, and mechanism by which the cartridges are drawn towards the chamber of the slide, I claim the circular arc projections and the correspondingly curved recess, the same being for holding the block in place or at rest while the toothed sector is out of engagement with the rack, and the lever is in movement to actuate the rod, as described."

79. For an *Improvement in Sewing Machines;* George A. Leighton, Assignor to Nehemiah Hunt, Boston, Massachusetts.

Claim.—"I claim combining with the longitudinal movements of the two needles of the sewing machine, lateral movements of one needle, so that the forward and backward movements of each needle shall be respectively on opposite sides of the other, instead of on the same side of it, whereby the crossings of the loops are made to be drawn into or directly over the holes made through the cloth or material sewed, and so as to produce very flat seam or sewing."

80. For an *Improvement in Machines for Making Wire Heddle Eyes;* Thomas Clegg, Assignor to himself and Nathaniel Stevens, Andover, Massachusetts.

Claim.—"I claim the combination of pressure jaws or mechanism with machinery for doubling and producing the twist in the wire, the said pressure jaws or compressing mechanism being for the purpose of flattening the twists of the wire. And, in combination with the pressure jaws or mechanism, and the mechanism for producing, doubling, and twisting the wire blank, I claim the movable carriage, and its jaws or mechanical equivalents therefor. Also, the combination of the stationary rest and movable disk with the slider or bearer, the shaft, and the rotary notch gear."

MECHANICS, PHYSICS, AND CHEMISTRY.

For the Journal of the Franklin Institute.

Thoughts on the Caloric Engine. By THOMAS EWBANK, Esq.

The substance of this paper was written a year ago, and withheld from the press lest it might be deemed a gratuitous interference with parties worthily striving to accomplish a great purpose. The "Caloric Engine" has now been so long before the public, that no remarks made on it can, in the slightest degree, affect it. It has become the subject of general—almost universal remark. No enemy, if it ever had one, can take from it aught belonging to it, nor fasten upon it defects from which it is free. Indeed, it is absurd to suppose discussion, or even bitter opposition, can at this day seriously injure, or injure at all, any project in mechanical science which appeals to actual experiment for proof of its worth. A truth in physics is as impregnable as a moral one, nor can the enthusiasm of the world in favor of an error successfully sustain it.

It is the *principle* of the engine that is here considered, not the mechanism at all, except so far as is requisite to elucidate the principle. Nor have the following remarks anything to do with the absolute mechanical equivalent of heat, which may, or may not, be greater or less than heretofore imagined. It may very well be that more power can be drawn out of heat when applied to air than has been obtained from its application to water; a result which, if attained, would simply show the equivalent to be greater than previously supposed, or that it varies with the media through which heat is employed.

The very bold and continued claims on behalf of the Caloric Engine have induced a disposition among some philosophers to give up the received theory of heat in relation to power, and to look out for another. To the practical man, speculations on heat, separate from ponderable agents it circulates in, are little more to the purpose than inquiries about the soul of a draft animal when estimating its strength or the work it performs. To him the "phenomena of latent heat," as regards liquids, are sufficiently accounted for by *diffusion*. A spoonful of syrup is less sweet when poured into a tumbler of water, still less in a gallon, and insensible or latent when diffused in larger quantities. Like heat in common air, or in a bar of iron, the syrup may, by concentration, be again collected. It suffices him to know, that heat is nature's grand expanding agent, and that nothing can be elastic without it; that every form of matter has its own share allotted to it, and when increased or diminished by external influences, the natural quantity is resumed when they are removed.

As regards the conversion of heat into mechanical action, it is now said that the work done is, in every case, proportional to the quantity lost, or destroyed, in the operation, and that whatever escapes, as in the puffs of steam from steam engines, has passed uselessly through them. Accordingly, it has been inferred that a low-pressure engine turns to account only 5 per cent., and a high-pressure one $2\frac{1}{2}$; that is, in the former, nineteen-twentieths of the power are wasted, and in the other, out of forty measures, all save one. Such is a recent French hypothesis. Those who have occasion repeatedly to load an engine to the verge of

its power, who observe how its pleasant movements become laborious strainings and its easy breathings prolonged groans, will hardly be persuaded that all the power above five or above fifty per cent. is then lost.

Supporters of this hypothesis differ from those of another, but their object is the same. With like feelings they direct their eyes to the hissing and roaring fluids rushing from waste pipes, like crowds of lusty laborers out of factory gates to play. It grieves them to see so much power dissipated. One party, thinking it has done no work, since it comes out so noisy and turbulent, proposes to give it enough to exhaust it; the other, beholding it so vigorous, thinks to send it back as often as it escapes until it breathes its last. Both, we apprehend, are mistaken. They resemble, to some extent, those who, having purchased goods and consumed them, wish for their money again, or for another supply without charge. There does not appear to us any sufficient reason or facts why a motive machine should be charged with imbecility or prodigal waste because it does not annihilate its motive element, nor yet why that element may not, after raising a piston, be discharged unscathed. The purpose is to use it, not to destroy it, and surely the heat of air and steam engines is no more annihilated than it is in the breath of animals, in air guns and sarbacans, in fire arms, digesters and common caldrons. In whatever machine it is employed, it finds its way (whether it do much work, or little, or none,) either through open channels or through the materials of its prison walls, into the atmosphere, the great and rapid equalizer of artificial temperatures.

Intricate reasonings on the principles and action of motive gas-engines will never be studied by the public, but there are salient points in them which the popular mind can perceive at a glance, and thence correctly infer the characteristic features of each.

Motion in them is caused by a change of volume which the motive fluid undergoes after being forced into a close chamber. It is there swelled by fire, and consequently requires more power to keep it in than was spent in putting it in prison; its increase of resistance being measured by its increased bulk, and the bulk depends on the heat it takes up. Had it undergone no change, the equilibrium of the machine would not have been disturbed, but now in its efforts to burst through the walls that confine it, the weakest part (the piston) gives way before it. After pushing this back, the object of its imprisonment, it is allowed to escape, when a fresh charge is introduced to drive back the piston to its former place, and the operation is repeated.

In these engines it is clearly desirable that the expanding agent should be presented in as compact or condensed a form as possible, since the resulting force depends on the quantity, not volume, of the matter dilated; hence solids and liquids give out more power than air, because its materials are already dilated into the gaseous state. Detonating compounds contain large volumes of gases. A pint of gunpowder gives out 250 gallons. A pint of water makes two hundred and twelve gallons of steam, while the same heat* that boils water would not swell a pint of air into a quart. Another striking mark between steam and air-engines, is, in the different dimensions of their feed-pumps. This is unavoidable, result-

* By this, it is presumed, the writer means not the same absolute heat, but the same sensible temperature.

ing, as it does, from the widely different densities of water and air. The feed-pump of a steam engine need not exceed *one-sixteenth-hundredth* of the capacity of the working cylinder; that of an air-pump is required to be *two-thirds*. The power abstracted by these from the effective force of their respective engines is in the same proportion. From the steam engine its feed-pump takes away only $\frac{1}{1600}$ of its power, while that of the air-engine abstracts no less than *sixty-six* per cent.

Thus, an air-engine can only transmit one-third of its power to any work to be done, while a steam engine gives out the whole, for the small amount withheld to work its pump is too trifling to be noticed in general results. We are therefore inclined to think, that air is too attenuated a body to supersede or successfully compete with steam by any further expansion that can practically be given to it.

But the efficiency or inefficiency of atmospheric air, as an agent for obtaining motive power from fire, would at this day have excited little attention had it not been connected with the surprising proposition that, by means of it, a mechanical force when once given out can be made to act a second, third, fourth, or fortieth time. This it is that marks the Caloric Engine as an extraordinary one—extraordinary for its claims—since, by no contrivance heretofore has the smallest amount of force been caused *to repeat itself*. We are constrained to believe it cannot, and that the idea is allied to those according to which power is ceaselessly to circulate through prime movers and the objects they move. Objections may be raised to references to the natural world, but we are very sure if the strange thing exists not in nature, it is opposed to nature, and exists not at all. Man makes not principles.

Several things are common to natural and artificial motors, but the gift of using the same power over and over is not among them; and yet, if man has the ability to impart it to insensible mechanism, it is strange that the Creator has not, in his benevolence, conferred it upon animals. From what an amount of suffering it would have saved them and us: the hungry, the weary, and aged, would never have drooped from exhaustion. A strong and sprightly horse goes to a day's labor, and returns weak and spiritless: his strength has gone out of him. How is he to recover it? Where is it? In the soil he has been ploughing? In the plaster he has been grinding? Or in the road he has been traveling? Be it where it may, it is never restored to him. A *fresh* amount may be produced in him, by means of food, and when it is gone, new nourishment brings in a new supply. Thus it is with all living, and so it is, we think, with artificial laborers. The power of the latter depends, as much as that of the former, on the food they consume. To revive their exhausted energies, they must be supplied with fresh meals. Withhold these, and their movements cease—so at least it has always appeared hitherto. But while both agree in this respect, they widely differ in another:—While one class, whether they work or not, are liable to perish of hunger, the others suffer nothing from prolonged fasting. They merely cease to stir till they are fed, and being insensible to pain and fatigue, are of greater endurance. Then, we can hasten the consumption of food in the stomachs of steam and air-engines, and keep them at work for indefinite periods, but not so with animals. There

is no working them for long periods without intermission—there is no cramming them, like the furnaces of boilers, nor applying blowers to hasten digestion: and if there were, we should be no nearer the object sought, since intervals of *rest* and *sleep* are indispensable to them.

It was ungenerous in the carrier who, without diminishing the labor of his team, reduced their fodder to the starving point; but attempts to extort a maximum of work from a minimum of food, did not begin with him. The Caloric Engine is allied to many, and the author contemplates a much greater saving than most of their contrivers hoped to effect. He proposes to get out of it, and while keeping it on remarkably short commons, not only as much work as the full-fed ones on board of steamers perform; but, by means of a "regenerator," it is to continue giving out power by swallowing over and over the essence of its spare and infrequent meals, the virtue of each swallow being deemed equal to that of a fresh meal. Whether inanimate, any more than living, prime movers can stand this, is a problem the Caloric Engine is to solve.

In every age, of which records have reached us, men have sought to leap over the boundaries that limit the range of their faculties, and the conditions imposed upon matter. Captivated by plausible suggestions, those of an inventive turn have mistaken illusions for realities, and have labored and reasoned to persuade the world they were right. Of these mockeries none have been more hotly pursued than an instrument which, as a consequence of the forms, proportions and arrangement of its parts, shall start into action, and continue to act till its materials wear out or its members fall asunder. To effect this, endless contrivances and modifications of contrivances have been tried, and, notwithstanding uniform and universal failure have marked all past and present efforts, there are still some, and even among the learned, who believe the thing possible; gentlemen who would certainly receive with incredulity the announcement of a similar creation in the animal kingdom. Of the two miracles, the one they hope to perform would be incomparably the greatest.

There are those who discard as absurd all attempts to gain power by wheels, springs, and levers, and yet imagine they can get it by fluids without giving anything like the usual price paid for it, and so specious have schemes on this plan appeared, that both experienced and inexperienced men have been led astray. As steam, for example, after raising a piston retains its properties and most of the power, or heat, it had in the boiler, it has been thought no difficult matter to withdraw it for a moment till the piston descends and then let it in again, instead of discharging and replacing it with a fresh supply from the boiler. Why, instead of a single exertion of its power, not compel it to urge the piston at least a few times to and fro before dismissing it screeching from service?

Of this class of inventors, Captain Ericsson is the most prominent now before the public. The principle on which his invention rests is, the repeated use of the same caloric. In his engine, as in the steam engine, *heat* is the animating principle, and in using over and over the same heat, he virtually and actually uses over the same power. He claims to have succeeded in seizing upwards of 90 per cent. of heat expended in raising a loaded piston, and in returning and compelling it to

do the same work over again; and that but for practical difficulties and imperfections attending the construction of a new class of machines, the *whole* heat might be saved from running to waste, and put at constant use. Captain E. is said thus to have reduced the consumption of fuel to an unheard of degree. Of this there can be no doubt, *if he is not mistaken.* Apply the same improvements to ocean steamers, and their boilers will be reduced to kitchen cauldrons and their furnaces to parlor grates.

The idea appears to have arisen (see further on), out of some undefined notions of the nature of heat, and that when united with a fluid medium it can somehow or other be used independently of the laws that control ponderable bodies.

Heat, or caloric—we use the terms synonymously—is a mystery, and so is Force. We know nothing of either except from its effects. It is only through bodies they act on that we can study them. In the Caloric Engine, heat is imparted to atmospheric air, and hence it is *air* that we have to deal with, and there is no more mystery about its mechanical action in that engine, than in a syringe or bellows. Additional heat communicated to it from the furnace, does not release it from any law to which it was previously subject; hence, when heat is employed as a motive power, it would make no difference if, in its nature, it were allied to the spiritual, since it comes under the same category, in the body that holds it, as any other power.

It was comparatively in late days, that the relation of heat to mechanical force was studied, and more recently, that their mutual equivalents were ascertained, or approximately ascertained; but, as will appear, the accepted doctrines in this branch of physics, are repudiated by Captain Ericsson. John P. Sargent, Esq., the solicitor for Captain E., in a Lecture before the Boston Lyceum, in 1844, on Ericsson's Inventions, [Wiley & Putnam, New York and London, 1844,] observes—

"The object of Ericsson's Caloric Engine, is the production of mechanical power by the agency of heat, at an expenditure of fuel so exceedingly small, that man will have an almost unlimited mechanical force at his command, in regions where fuel may now be said hardly to exist. The announcement of such an idea may startle all those acquainted with the nature of heat, and the well known limits of the amount of mechanical power which any given quantity of caloric is capable of producing; more particularly, as it is a well-established fact, that a given quantity of heat will exert an equal amount of mechanical power, to whatsoever medium it may be imparted.

"Ericsson's theory of heat is altogether in opposition to the received notion, that the mechanical force produced will bear a direct known proportion to the quantity of caloric generated. * * * * The basis of the Caloric Engine is, that of returning the heat, at each stroke of the piston, and using it over and over again. * * * * This result Captain Ericsson has accomplished by means of an apparatus which he styles a *regenerator;* and so perfectly does it operate, that the heat employed in first setting the engine in motion, continues to sustain it in full working force, with no other renewal or addition than may be requisite to supply the inconsiderable loss by radiation."—Pages 51-55.

This is what Ericsson and his friends still claim, and assuredly if he can, by any device, regenerate an ounce of power, or if he can send half an ounce back to the working cylinder and make it do its work over and over again, he has done what man never did before him, and what the Creator has not, that we know of, done in any one of His motive machines.

The regenerator is an ingenious device, but not what its name implies. It is at best but an economizer of heat in the same sense and after much the same manner as contrivances by which waste steam of engines imparts heat to cold water supplies, and it is yet to be proved, that in either case, *any* heat is absolutely saved, except it be from a surplus admitted into cylinders over that required to move the pistons; and even then, whether what is arrested and returned to the receiver or boiler, be not procured at an expense equal to its value. We worked a stationary high-pressure engine for years; the steam, after doing its work, was conveyed into a wide and shallow box in which two or three fathoms of the feed pipe (between the pump and boiler) was coiled. The cold water ere it entered the boiler, was thus raised to about 160° F. That this additional temperature derived from the waste steam was a clear gain, was never imagined. The additional power consumed in driving the water through the coiled tube, and the increased retardation of the steam's exit from the cylinder in consequence of its diversion through the box, were clearly paid for it, if nothing more. So with the regenerator; its meshes of wire perform the part of the coiled pipe, but more perfectly because they mix directly and more intimately with the fluid to be heated; still, in proportion as they do this, they retard the air's passage through them. If it oozed through layers of finely granulated metal—fine as that used in place of sand in ships' hour-glasses—it would give out and take up heat still more readily, but then its passage would be more obstructed than by the metallic gauze, and more power would be expended in driving it through.

The idea of extracting more out of a force than is in it, will probably never be obsolete. It presents itself in such diverse and pleasing forms, that parties will always be found to cherish it. Appearing in the mien, garb, and winning simplicity of truth, the illusion is singularly successful in the tenacious faith of its votaries. Vanishing under investigation, it re-appears as soon as that is over, and, in nine cases out of ten, is more warmly received than before its character was questioned.

Every one knows that it takes some power to lift a load from the ground, and that it must be more than equivalent to the load, since, if merely equal, the two would be balanced, like equal weights in a pair of scales: one could not overcome the other. Then no one is ignorant, that if the load be dropped again, it cannot be lifted a second or third time with less power than was required for its first elevation: in other words, that it does not grow lighter by falling, nor the power stronger by lifting it. This is manifest, and yet attempts to "gain power," whatever may be the materials and devices employed, are virtually efforts to lighten the load, or to raise it with less than its equivalent of power.

It may not be agreeable to believers in the alleged powers of the Caloric Engine to have it associated with attempts at perpetual motion, but if the claims respecting the virtue of the regenerator are just—if by it the same power is actually used over and over—the old popular fallacy is, or is about to be, a great modern truth, and the greatest of all mechanical truths; for by it power barely sufficient to forge a nail, may, in time, be kept going till it fabricates tons, and heat that once drives a vessel over the Atlantic or locomotive over a railroad, will suffice to propel them to and

fro for an indefinite number of trips. Losses by leakage, radiation, &c., be it remembered, affect not the *principle*. They are incidental difficulties that may be overcome. What, then, if the principle affirmed *be* true, is there to prevent power expended in sawing a plank, making a shoe, weaving a carpet, ploughing fields, &c., from going on producing and ploughing; or the labor expended on the erection of a house, from building a city, or when a mile of railroad is once made, from the same power continuing it round the globe.

Captain E., it may be said, dreams of no such things. Suppose he does not: it is not the less true that these are natural and unavoidable deductions from his proposition. It is the principle that is in question. Establish the fact that mechanical force *can* be made to repeat itself, and no matter to what extent—large or little—Captain E. or any one else has carried, or may carry, it out. But Captain E. and his friends do contemplate the performances of miracles akin to those named: they expressly assert of the Caloric Engine, "its object is the production of a continued force almost without reference to the amount of the original exciting cause." (Sargent, p. 60.) The "almost" being inserted to meet small deductions arising from practical imperfections. M. Foucault, the celebrated inventor of the Pendulum experiment, for rendering the rotation of the earth visible, thinks the Caloric Engine "has conquered a great principle," and that it "all but leads to the conviction that the perpetual motion is at last discovered."

The repeated or continued use of the same power is the essence of the perpetual motion; and while not one seeker has found it, every one thinks he has got nearer to it according to the per centage of power he has gained, or, in other words, "used over and over." Now the fact is, that *any* portion, large or small, thus gained, is equal to gaining the whole. When 90 per cent. of power is used, say only *once* over, 180 will have been got out of 100. And if one or one-tenth of one per cent. be "used over and over again," the same miraculous result follows—a part will be found greater than the whole—and infinitely greater, too.

But, as we observed, there is no making pounds out of pennies in the currency of force: capital in it carries no interest—neither simple nor compound.

(To be Continued.)

For the Journal of the Franklin Institute.

An apparatus for Organic Analysis by Illuminating Gas, and on the use of this Gas in Experimental Laboratories. By CHARLES M. WETHERILL, Ph. D., M. D.

(Continued from page 115.)

The parts of the Apparatus separate from the Combustion Tube.

These consist of the stands for holding the drying and absorption apparatus, and conveniences for passing the oxygen and air during the combustion. I think gas bags of vulcanized caoutchouc are preferable to the use of Pepy's gasometer, as the inconvenience of the use of water is avoided and space is economized. Two of these are used, of a size large enough to hold gas for five or six analysis, and are placed under

the table, pressed each between two boards united by a hinge. They can be loaded with weights just sufficient to give the requisite pressure to the gas contained in them, which enables the current to be kept under better control, and the pressure remains pretty constant during the analysis which contributes to the same result. The gas passes up through the table by means of india rubber tubes connecting with gallows screws to the apparatus. In preparing oxygen from the chlorate of potassa of commerce, the gas is contaminated by certain compounds of chlorine which would interfere with the accuracy of the analysis. These may be removed by passing the gas through a solution of caustic potassa; but as the oxygen by the method of preparation in use comes off with great rapidity, there is danger of it being insufficiently washed. I have obviated this by a peculiar construction of the end of the tube which delivers the gas into the washing fluid. The end of this tube is drawn out to afford a handle, and sealed: a bulb is then blown, and during the process, drawn out oblong by means of the handle, which is then cut off closely. Of course, it must be made of diameter to slip readily into one of the necks of the Woulfe's bottle. Three or four zones of fine holes are then made close together, and to each other, around the bulb, which, as the glass is thin, is best effected by heating the platinum wire (instead of the glass) close to the bulb, and pushing it through, and quickly drawing it out after removing it a short distance from the flame. After cutting off with a file the little tails thus formed, the edges may be smoothed in the flame. It is plain, that with such a tube dipping into the washing bottle, the gas will be separated into a great many streams, which dash on all sides through the liquid; when the pressure is moderate, the upper zone alone will permit the escape of the gas, but with increase of pressure the lower zones will come into action, and the greater the pressure the more the gas will be divided, and consequently the more effectually washed. This form of wash bottle would be useful for a great many purposes of absorption in the laboratory. When the oxygen current is at its greatest degree of rapidity I have not observed any of the liquid to be carried over, though it is violently agitated and stirred in all directions. As it is easy to dry the gas at the same time, it passes from the potash solution into a wash bottle exactly like the former, containing oil of vitriol; it thus enters the gas bag perfectly dry, and deprived of chlorine compounds as well as of any carbonic acid resulting from impurities in the chlorate of potash. The air is pumped into its appropriate bag by the table blow pipe, the air duct of which is connected with the same washing apparatus described above. Though the oxygen and air have been thus purified and dried, for precaution's sake, as well as to be able to watch the gas current at this end of the apparatus, it passes through oil of vitriol in a Liebig's potash apparatus, and through sticks of caustic potash in **U** tubes; these are suspended upon a stand, on the extremity of which are situated the cocks for controlling the kind and supply of gas to be passed through the combustion tubes, and which are represented in end view at fig. 7,* Plate III. It is an advantage, especially in the case of double combustions, to be able to pass either air or oxygen independently of each other, to the two combustion tubes, and without the need of connecting or disconnecting the

* Scale ½.

drying apparatus, and at the same time to effect this with but two gas bags, one for the air and one for the oxygen. This end is obtained by the two three-way cocks, represented in section at the bottom of the stand, fig. 7, and the tubes connecting, which are, for the greater perspicuity, represented out of their natural position. Each of these cocks has an opening into which the vertical tube *a* is soldered, and two lateral openings. The two interior lateral openings *e e'*, are connected with a tube having an exit *b*, on which is fixed the gallows screw, connecting by india rubber hose with one of the gas bags, say the air one. The outside openings of the cocks are connected with another tube bending around them and opening at *b'* into the connexion with the oxygen bag. In natural position, these tubes are fastened firmly to the bottom of the stand, and the gallows screws stand vertically. The plugs of the cocks have only two openings, and the handles which operate them are placed in their angles of intersection as seen at *g* and *g'*. It is plain, that when this handle is placed vertically, all the holes are closed; when turned to the right, a connexion is made between the vertical tube *a* and that to which the handle inclines; when turned to the left, it connects the other tube with the tube *a*. In the drawing, *g* is placed so as to connect *a* with *e*, opening into *b*, or passing air through the combustion tube. In the other cock, *g'* is placed so as to connect *a'* with *d'* and *b'*, or in this case so as to pass oxygen. By means of small tubes of caoutchouc *a* and *a'* are connected with the drying apparatus suspended on the stand. This is constructed with two upright supports, into which rods slide that may be kept in position by binding screws. The tops of these rods are connected by a piece of thick sheet brass, about an inch wide and in a horizontal plane; upon this brass are placed the clamps represented at *c*. These clamps may be fixed in any position on the brass plate, and by their means and by the sliding rods the connexions with the combustion tubes may be adjusted in their proper positions. There is another stand like fig. 7, without the cocks and somewhat longer, for holding the chloride of calcium tube and potash apparatus. It is important to give the potash apparatus an inclined position; this is effected by giving one turn around the two sliding rods *f*, with a thin copper wire united at the ends; a piece of wood of the proper length is placed so as to keep apart the two wires running parallel between the sliding rods. By advancing this wood towards the two potash bulbs, the requisite inclination may be given to them, and as it is better to have the larger bulb of the potash apparatus situated where the gases of combustion leave it, it will be best to have the tubes of the potash bulbs so bent that one apparatus can be used on one side of the stand, and the other on the opposite; the piece of wood above mentioned will then, by keeping the two apparatus apart, give them the proper position. The tubes rest in the forks of the clamps, two clamps being necessary for each piece of apparatus.

Mode of Performing the Analysis.

The combustion tubes being filled (so as to leave a passage of half the diameter of the tube) with oxide of copper to near the part heated by the gridiron burners and kept in position by plugs of asbestos, and the small cocks of A, (fig. 1,) being all open, the gas is lighted and the tubes raised

to a red heat, the handles of the cocks *g g'* (fig. 7) being placed so as to pass a slow current of air. When the oxide of copper has been thus dried, small chloride of calcium tubes are placed in the ends of the combustion tubes, and the current of air being stopped, the gas is shut off. While the tubes are cooling the different parts of the apparatus for the absorption of the products of combustion are weighed, and also the platinum trays containing the substance to be analyzed. When these have been placed in position, the small cocks at A, fig. 1, and the large cock feeding them, are shut off, and the front and back parts of the combustion tubes raised to a red heat, after which the combustion of the substance is effected at A, fig. 1, by gradually advancing the heat from end to end in the manner indicated in a former part of the article. At this stage of the combustion, if it is not possible from danger of explosion to pass oxygen, a slow current of air is passed instead. At the close of the operation, a coaly residue remains in the platinum trays, which is burned off by passing oxygen, which is continued to be passed until it comes out at the end of the U tube containing solid potassa, which is attached to the potash bulbs. The handles of the three-way cocks are then reversed so as to pass air, which is continued until it replaces all of the oxygen. The chloride of calcium and potash apparatus and platinum trays are now weighed, and every thing is ready if required for a second double analysis.

The cost of gas for an analysis as ascertained from the metre during a double combustion, is two and a half cents, the gas costing at the rate of two dollars per thousand cubic feet.

Experiments with the Apparatus.

Before proceeding to analysis with the apparatus, experiments were made to test its freedom from sources of error, but, first of all, with regard to the change of weight which has long been observed to take place in the chloride of calcium tube and potash apparatus. This has been attributed to a change of hygrometric state by the heat during the combustion, and it has been, therefore, recommended to wait a half of an hour after the combustion before making the final weighing. Regnault has advised the use of a similar apparatus on the other scale for a counterpoise to counterbalance this error.

To ascertain the circumstances of this change of weight, the chloride of calcium tube and potash apparatus cleaned and prepared for analysis, were repeatedly weighed at intervals during a day, being careful to touch them only with intervention of a piece of paper, and keeping, in the intervals, the ends of their tubes closed with little caps of caoutchouc. During the intervals of weighing, they stood sometimes quite close to the balance (near which hung a Mason hygrometer) and never at a greater distance than four feet, which did not seem to alter their behaviour. The balance (one of Oertling's latest) has been long proved as to its delicacy and accuracy; the beam divided decimally, enables half milligrammes to be weighed by a rider, and having further divided the beam accurately with a pair of dividers and having suspended a lens in front of the index needle, I can weigh with confidence to quarter milligrammes and even (though not so surely) to tenths. While I have for the past few years

observed a variation in the weight of glass apparatus, the various platinum vessels in use have maintained their weight with a surprising constancy; one small crucible used for incinerations having lost during four years, only one-half a milligramme, and yielding the same weight without fluctuations, no matter how often it is successively weighed.

The following table indicates the result of consecutive weighings of the potash apparatus. Column A shows the intervals of the successive weighings, and B the difference from the preceding weighings in milligrammes and quarters, + denoting an increase, — a loss, and 0 no change; C indicates the difference between the different weighings and the original weight.

A	B Milligrammes and fractions of the same.	C
	Difference from preceding weight.	Difference from original weight.
Original weight 60·5955 grammes.		
5 minutes after the preceding,	0	0
33 " " " "	+0·75	+0·75
25 " " " "	0	+0·75
35 " " " "	—0·50	+0·25
1 hour 40 minutes after the preceding,	+0·25	+0·50
1 " 29 " " "	—1·00	—0·50
2 " 6 " " "	0	—0·50
17 " 0 " " "	+0·50	0

From C it appears that in 24 hours the potash apparatus had attained its original weight, though varying constantly in the interval, as seen from B, and without any apparent law. The dew point observed by a Mason's hygrometer in the neighborhood of the balance did not vary (during the day-time when observed) by an appreciable quantity. The greatest variation between the successive weighings was one milligramme.

In the following table, for the variations of the Ca. Cl. tube, the letters indicate the same things as in the preceding table.

A	B Milligrammes and their fractions.	C
	Difference from preceding weight.	Difference from original weight.
Original weight 40·55975 grammes.		
17 minutes after preceding,	+1·75	+1·75
40 " " "	—1·00	+0·75
18 " " "	0	+0·75
1 hour 57 minutes after preceding,	—80	—0·05
1 " 16 " " "	+80	+0·75
1 " 17 " " "	0	+0·75

The next morning, the Ca. Cl. tube differed +1·50 milligrammes from the preceding, and + 2·25 from the original weighings, doubtless owing in a great measure to absorption of water by the chloride of calcium.

It appears from the above results, that the error of analysis from this source, and which is no doubt generally compensated in the two weighings, varies from one to one and three-quarters of a milligramme; this

error, with the quantity of organic substance usually taken for analysis, falls in the hundredths of the per centage calculation.

The following are the results of combustion without organic substance, to prove the working of the apparatus.

The Ca. Cl. apparatus was first connected to the caoutchouc tube which delivers air or oxygen to the combustion tube; to the Ca. Cl. apparatus was connected the potash apparatus, together with its accompanying U tubes, filled with caustic potash and weighed with it.

After passing oxygen for an hour and a half, in a moderately rapid current, the Ca. Cl. tube had gained $3\frac{1}{4}$, and the potash apparatus, $4\frac{1}{4}$ milligrammes. After passing a current of air for fifteen minutes, the Ca. Cl. apparatus returned to its original weight, while the potash apparatus indicated a loss of $\frac{1}{2}$ a milligramme. Passing air for an hour and a half longer, the chloride of calcium tube gained a quarter of a milligramme, and the potash apparatus experienced a further loss of one milligramme.

From this it follows, making the allowance for error in weight and a slight loss from evaporaton in the potash apparatus, greater than would occur in actual analysis, that the air and oxygen prepared by the method described in a former part of this article, are free from any cause of error for the analysis.

The apparatus were then attached to the combustion tube, as for an actual analysis, after having ignited the oxide of copper in oxygen and suffered it to cool in the air current, the corks were coated carefully with tin foil, and not dried. The combustion, (without substance,) was then proceeded with, passing oxygen for forty, and air for twenty-five minutes.

The chloride of calcium tube, weighed immediately after, had gained $6\frac{3}{4}$ milligrammes, and forty minutes later, two additional milligrammes; while the potash apparatus, immediately after, showed an increase of two milligrammes, and forty minutes later, returned to exactly its original weight.

A second experiment, under the same conditions as the last, and with fresh corks, gave a gain to the chloride of calcium tube, of $11\frac{3}{4}$ milligrammes, and three-quarters of an hour later, a further gain of $\frac{3}{4}$ milligramme. The potash apparatus, weighed immediately after the combustion, indicated a loss of two milligrammes, and $\frac{3}{4}$ of an hour later, returned to within $\frac{1}{4}$ of a milligramme of its original weight.

A third experiment with fresh corks, gave a gain of $5\frac{3}{4}$ milligrammes, and weighed an hour later, an additional milligramme, to the Ca. Cl. tube; the potash apparatus indicated no change of weight, immediately after the combustion, but an hour afterwards, had gained $\frac{3}{4}$ of a milligramme. It follows from these experiments, that coating the corks of the combustion tube with tin foil, as proposed by Marchand, does not prevent their giving up water to the Ca. Cl. tube; but if the cork be dried, as indicated by Liebig, accurate results are obtained without any tin foil coating, as the following experiment shows, in which the corks were kept over night in the Thermostat, at a temperature of 130° Centigrade.

The Ca. Cl. tube experienced a gain of only $1\frac{3}{4}$ milligrammes, and the potash apparatus one of $\frac{1}{4}$ milligramme.

A gain of 9 milligrammes of water, is equal for 400 milligrammes of substance to an excess of 0·25 per cent. of hydrogen.

The following analyses of sugar, were made from sugar candy, powdered, and kept for some time in the Thermostat, at a temperature of 100 Centigrade. The per centage of ash in this sugar, as determined by weighing the platinum dish after the analysis, was 0·09 per cent.; this was subtracted from the original amount of substance, in calculating the results. By theory, the sugar should give a per centage of 42·10 carbon, and 6·43 hydrogen. The first three analyses made with the apparatus gave—

Carbon, = 41·74; 41·51; 41·91.
Hydrogen, = 6·56; 6·70; 6·76.

The combustion tube contained oxide of copper in front, and behind the platinum tray was a plug of copper wire oxidized on its surface and about three inches in length. This latter was found disadvantageous, in rendering the tray dirty, and thereby interfering with weighing the ash, and besides seems to be of no use, if the gas current inside the tube be properly regulated. In the last two of the above analyses, which were made together, as a double combustion, the state of the metre was observed, and from beginning to end, (for the double combustion,) somewhat less than 25 cubic feet of gas were used, which at the present rates, gives a cost of about 2½ cents, for a single combustion.

I endeavored to substitute for the oxide of copper, a porous mass, made by forming spirals of thin copper wire, around a knitting needle, and packing them in the combustion tube. The surfaces were oxidized by heating in a current of oxygen, and it was supposed that by thus increasing the oxidizing surface, a much shorter portion of tube in front of the platinum tray would be required; but the results turned out entirely bad; these analyses of the same sugar, gave—

Carbon, 38·89; 40·09; 39·54.
Hydrogen, 6·17; 6·26; 6·15.

Independently of these bad results, in case of breaking the combustion tube, it was difficult to extract these spirals without unrolling them on account of their rough surfaces adhering to the tube.

The following analyses of sugar were made with oxide of copper in the front part of the combustion tube; but without anything behind the platinum tray. The ash was not taken into calculation.

Carbon, 41·46; 41·89; 41·83.
Hydrogen, 6·51; 6·62; 6·56.

In none of the preceding analyses were the corks dried, but enveloped with tin foil, according to Marchand's suggestion, which was afterwards found to be ineffectual. The hydrogen, therefore, is somewhat too high from this source. The following analyses were made upon the fat of human adipocire, crystallized several times from hot alcohol, but not treated according to Heintz's process; the fat was tinged slightly yellowish and left no appreciable ash.

Carbon, 74·16; 74·63; 74·00; 74·70.
Hydrogen, 12·66; 12·76; 12·57; 12·47.

Analyses of fatty bodies require the greatest care in their performance, and the first stage of the combustion must be performed in an air current,

as oxygen gives rise to explosions in the combustion tube. Several analyses were lost in this way. Of the above results, the first was made with oxygen, and was the only one which succeeded; in all the rest air was used.

(To be Continued.)

Translated for the Journal of the Franklin Institute.

On a new System of Gearing for Machinery. By M. Minotto.

[Report of a Committee of the Society for the Encouragement of National Industry, Paris.]

M. Minotto, Vice-Director of Telegraphs in Piedmont, presented to the Society models and a description of a new system of gearing, called *wedge-gearing*, which is proposed to replace, in a number of cases, the common toothed wheels.

The complete study which he has made of this interesting question, deserves the attention of the Society: for the invention of a new mechanical element, having special properties, is no mean advance; it is an additional means of new progress.

Every body knows the properties of the wedge to multiply upon its lateral faces the force applied upon its back in proportion to the angle, so that in an isosceles wedge, the force exerted on either face is to the force applied on the back, as the height of the wedge to one-half of its breadth. Upon this property M. Minotto depends to increase the adhesion of wheels, without increasing the pressure on their axes in the same proportion. Thus, if it be required to drive two parallel axes by the contact of two pulleys mounted upon them, we know that it is necessary to press strongly in order to prevent slipping, whenever the forces to be transmitted are at all powerful, and in consequence to cause considerable friction on the axes. The same thing will not take place if a groove be

Fig. 1

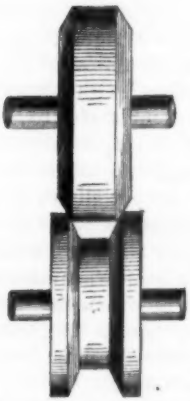
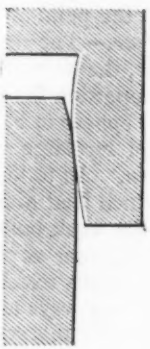


Fig. 2.



turned on the outer face of one of the pulleys, and the face of the other be of conical form, so that it may enter partially in the groove of the former, (Fig. 1.) All the properties of the wedge re-appear here; that is to say, in consequence of the greater or less acuteness of the angle of the

groove and its corresponding projection on the other wheel, the section of which presents a truncated cone, a small pressure on the axis may cause a very great pressure at the contact, and thus an adherence, by means of which one wheel will drive the other, overcoming the resistance which opposes its motion.

This is the principle of the system—let us endeavor to explain the advantages of its use.

Of the Slipping.—The most remarkable character of this system of gearing is, that a slipping may take place from a change in the forces. This property, which renders it improper to replace toothed wheels in systems where these are intended to assure certain rates of motion, as in horological apparatus, makes it, on the contrary, extremely valuable for applications where the resistance may undergo considerable changes, which is a continued cause of fracture of toothed wheels. This resemblance with the system known under the name of *friction-cones*, ought to be carefully observed, and constitutes an important property of the new system.

Of the Friction.—It seems that the sliding friction which is exerted on the faces in contact, especially beyond the primitive circumferences, ought to be a cause of inferiority of this system; but it is to be remarked that, in the momentary rubbing of the surfaces of contact around the mean point which defines the primitive circumferences, the parts further from this point wear out much faster than those which only roll, and, consequently, the face of the wedge has a disposition to take a convex form, which tends to reduce very much the value of the friction, (Fig. 2.) According to the calculation, the new system will offer a notable superiority over the toothed gearing, whenever the angle at the apex of the wedge is below 20°. Moreover, the inventor demonstrates that greasing, which much diminishes the friction, has but little influence upon the adhesion of contact, which is explained by the almost complete expulsion of the lubric at the point at which the greatest pressure is exerted.

Of the Wear.—The rapidity of wear in this system of gearing, and, consequently, the necessity of a gradual approximation of the axes so as to always proportion the pressure and adhesion to the resistance to be surmounted, appear to be the most prominent obstacles to the adoption of this system for large machines, although this approximation is often easy to obtain. As to the wear itself, although the author has made experiments which lead him to believe that it is very slight, yet it appears to us to be the weak point of the system, whenever it is not possible to multiply the number of wheels placed upon the two axes, which the lathe permits to be easily executed. So that, as the pressure on each point of contact may be always much less than that at which the destruction of the metal is rapid, this system may be employed for a long time, provided the axes can, from time to time, be brought nearer, and the conical groove be deep enough to work with a considerable wear.

We will enumerate here the arrangements contrived by M. Minotto to avoid and remedy the wear: first, the greasing to avoid jamming; secondly, the use of disks forming the wheels when united by means of bolts, wheels whose thicknesses may be varied by changing the block interposed between the disks.

Applications.—The system of wedge-gearing may produce not only motions of rotation, but also rectilinear motions by arrangements analogous to racks, cams, &c. M. Minotto proposes two applications, the one to rectilinear, the other to rotary motions, which we will here indicate:

One of these applications relates to railroads, and consists in the use of a grooved wheel, gearing upon a bar of iron placed in the middle of the track to increase the adhesion of locomotives in the ascent of high grades. The other employment which M. Minotto recommends, consists in the employment of the wedge-gearing for the transmission of the rotary motion to the large main axes of propeller steamships, which must move rapidly to operate usefully upon the liquid.

We only announce these two applications, which have not been put in practice and studied in detail, but which possess interest.

Signed, CH. LABOULAYE, *Reporter.*

For the Journal of the Franklin Institute.

An Account of some Comparative Experiments made at the Washington, D. C., Navy Yard, April, 1854, *on the ordinary mode of setting Land Boilers, and on the mode patented by* HENRY F. BAKER. By B. F. ISHERWOOD, Chief Eng., U. S. Navy.

The following detail of some comparative experiments made at the Washington Navy Yard, with the "ordinary" mode of setting cylindrical land boilers, and with the mode patented by Henry F. Baker, are of considerable value to mechanical engineers, both as regards the positive results obtained, and as definitively exploding a false theory. The "ordinary mode," shown in Fig. 1 of the diagram acompanying this article, is so well understood as not to require description: Mr Baker's method, shown in Fig. 2, is described in the following "claim," forming his patent, dated May 30, 1846, viz.

"What I claim and desire to secure by Letters Patent, is one or more reverberating chambers (made and arranged as above set forth) in combination with the fire-place and boiler, the same being made to revolve and retain the volatile products underneath the boiler, long enough to be consumed thereunder, as above explained; and I also claim, the manner of arranging the air distributing boxes with respect to the bottom of the boiler in combination with the curved deflecting bottoms of their respective chambers, in order that the flame produced by combustion of the volatile gases, or other matters, passing over the perforated plates of said air boxes, may be blown in jets against the bottom of the boiler as set forth; the said mode of arranging the said air boxes consisting in giving each of them an inclined position substantially as represented in the drawings and as above specified."

In the above claim, the object to be attained by the reverberating arches or chambers, is "to revolve and retain the volatile products underneath the boiler long enough to be consumed;" and in the pamphlet published by Mr. Amory, the General Agent of this patent, he says, "the improvement with Baker's furnaces is to be accounted for by the *more*

perfect combustion of the gaseous products of the fuel, which by the reverberations are retained longer and brought more intimately in contact with the atmosphere, thereby *converting much carbonic oxide* (which in ordinary furnaces escapes into the chimney) into carbonic acid, and occasioning a great saving of caloric."

Now, according to the above, Mr. Baker's arrangement is an attempt to remedy a defect which does not exist, as nothing connected with steam boilers is better determined than that with the ordinary proportions of practice, and even with proportions differing extremely from them, no carbonic oxide is formed in the flues; this has been the unvariable result of a considerable number of chemical analyses of the products of combustion in the flues and chimneys of steam boilers. The only manner in which carbonic oxide can be formed, is by deficiency of atmospheric air to furnish the necessary quantity of oxygen to completely oxidize the carbon and hydrogen of the fuel; but the ordinary proportions of practice is found to furnish about *twice* as much atmospheric air as is required for perfect combustion; consequently, so far from carbonic oxide existing in the flues, there is always found in them a large quantity (about ten per centum) of free or uncombined oxygen.

Supposing, however, that carbonic oxide did exist in flues, it could not be converted into carbonic acid, by the manner proposed by Mr. Baker, which is by presenting to it a further supply of oxygen from the atmospheric air admitted at the bottom of his arches through the perforated plate; but cold atmospheric air presented to carbonic oxide at the moderate temperature of the flues, will not saturate it with oxygen in the short time they remain together in the boiler; consequently the only effect of these perforated plates will be the injurious one of cooling the boiler by the amount of cold air admitted.

This effect seems to have been observed by the Patentee, as the "perforated plates" are omitted in the arrangement of the chambers beneath the experimental boiler at the Washington Navy Yard, and a new feature is introduced *not patented*; viz., the front of the ash pits is closed, and the air for combustion is delivered beneath the grates through a pipe which first traverses beneath the inverted arches through a space filled with the heated gases of combustion, so as to supply the fuel with heated atmospheric air. This arrangement is as erroneous as the other, for it has been abundantly proven by careful experiments that no advantage is derived from the use of heated atmospheric air, because a given bulk of such air contains, on account of its greater rarefaction, less oxygen than the same bulk of colder air; consequently, the less amount of caloric required to raise the temperature of the heated air to that of the furnace, is compensated by the greater amount of such air required for the combustion of equal amounts of fuel.

Again, as far as regards the "revolving and retaining" of the heated gases by means of the arches, it is quite certain these gases will not be at all *revolved* or *retained*, but instead of following the shading in Fig. 2 representing their course, according to Mr. Baker, they will follow in a straight line, taking the shortest and most direct route from furnace to chimney, and leaving the arches beneath the dotted line, Fig. 2, filled

with quiescent gases. In a word, the reverberating chambers of Mr. Baker do not reverberate, and cannot, as arranged, be made to do so.

Could these chambers be made to readily do their supposed office, that is, retain, revolve, and mix up the gases in the flues, they would be highly beneficial, but not for the reason supposed by Mr. Baker, which is the conversion of carbonic oxide into carbonic acid; but for the following reasons, viz. When a mass of heated gases passes through or beneath water (as in the case of steam boilers) only a thin film of its periphery or envelope can be in contact with the water, consequently, the heat can be extracted (which is quickly done) from this film only, leaving the heat of the central portions of the mass unextracted, until by their less specific gravity, the result entirely of their higher temperature, they rise, displace the already cooled film, and present another film, from which the heat is in turn extracted, when it obeys the same law and sinks, its place being supplied by still another film, and so on. This is the only mode in which the caloric of the mass of hot gases can be extracted, and this mode is due solely to the action of gravity; were there sufficient *time* allowed, the gases being retained in contact with the water, their heat would undoubtedly be thus extracted down to the temperature of the water; but *time* is the very element impossible to be obtained; the gases in the flues of boilers are constantly flowing on to the chimney with considerable rapidity, even with the slowest combustion, not only rendering the interval of time elapsing from their leaving the furnace to their arriving at the chimney very short, even in the longest boilers, but neutralizing the action of gravity among their particles by the momentum imparted to them by the speed of the current or draft. Hence, with a thick mass of hot gases, or a mass having considerable area of cross section, a great waste of caloric results from the interior gases going into the chimney at a high temperature, but by making the mass thin, this effect is decreased and a greater amount of heat extracted. Now, could any plan be arranged of *beating up* the gases in the flues, or, in other words, of mechanically mixing them rapidly together, it is plain the temperature of the whole gaseous mass would be kept about uniform, instead of being of nearly the initial temperature in the interior and comparatively cool at the periphery. The arches of Mr. Baker will not perform this office, and therefore are useless, a conclusion fully borne out by the unexceptionable experiments made at the Navy Yard and hereafter described.

I have frequently thought that in the ordinary horizontal flues a tolerably complete *beating up* or mixing of the gases might be effected by *obstruction*, that is, by arranging in the flues, at short distances apart, flat iron plates or bricks, against which the flowing mass of the gases would strike and break like water against a board held in a rapid current, and then by eddying around behind produce a mixing up. The flues should of course, have a sufficient cross-section to admit these obstructions and retain draft enough for consuming the requisite amount of fuel. The obstructions should also be so arranged as to admit of their easy withdrawal for sweeping the flues, &c.

By the arrangement of the heating surfaces of steam boilers in vertical tubes, these tubes containing the water and standing in the mass of moving, heated gases which surrounds them, as in the boilers of the Collins'

line of steamships, the breaking up and mixing of the gases are very completely attained, the tubes themselves acting very efficiently as *obstructions;* and to this cause alone, I ascribe the very great superiority of this type of boiler, which, when properly proportioned, gives, incontestibly, under the ordinary conditions of practice, the maximum possible economical evaporation, and far exceeds, in that respect, any results possible from the other types in use.

The results of the comparative experiments hereinafter given, and made by Engineer-in-Chief, D. B. Martin, at the Washington Navy Yard, differ so vastly from the results of other experiments made by different persons and published by Mr. Amory, the General Agent of Baker's Patent *Setting*, that a brief review of these latter is necessary. In the experiments published by Mr. Amory, we are at once struck by the very large evaporation, considering the type and proportions of the boilers used, stated to have been obtained both by the Baker and the ordinary mode of setting. With a view, therefore, to obtain a precise limit in this direction, it is necessary to determine the *total theoretical evaporation* of the coal; that is to say, to determine the number of pounds of water which can be evaporated by one pound of coal, supposing its combustion to be perfect, and all the heat generated by that combustion to be imparted to the water, none being lost by radiation or by passing off in heated gas to produce a draft, or in any other manner whatever. It is evident that such a limit exists, and that this limit is the total theoretical evaporation by the coal.

The organic combustibles, coal, peat, lignite, and wood, are composed of carbon, hydrogen, and oxygen, earthy and other matter being merely mechanically or accidentally mingled. The hydrogen and oxygen produce during the combustion no heating effect when they exist in the proportion necessary to form water, because in the decomposition of water as much heat is absorbed as is disengaged in its formation; hence results, that the heating power of any coal is in the proportion of the carbon it contains, and of the excess of its hydrogen over the quantity required to form water with the oxygen. But this excess of hydrogen when it exists in coal at all, exists in the solid state, and as it volatilizes at a low temperature it must be consumed in the furnace in the state of gas: by the very process of volatilization heat is absorbed or rendered latent, and though no determination has ever been made of how much of the heat generated by the combustion of this hydrogen is required for its conversion from a solid state into gas, yet the amount is so considerable that taken in connexion with the very small per centage of *excess* of hydrogen existing in any coal, its effect may be considered insensible and practically neglected; as may also the effect of the very minute amount of mineral combustibles, sulphur chiefly, occasionally found mingled with the coal. From the foregoing it follows, that *practically the heating power of coal is simply in the proportion of the carbon it contains:* this being the case, it is necessary for our purpose to ascertain the total theoretical calorific power of carbon, which has been done by the following two authorities, viz.

Despretz determined that 1·00 units of weight of carbon is capable of heating 78·15 units of weight of water, from the freezing to the boiling

point, or, in other words, of giving out ($78{\cdot}15 \times (212-32) =$) 14067 units of heat.

Dulong's similar determination of the heating power of carbon is, 13268 units of heat per unit of weight of carbon.

The mean of these two determinations is 13668 units of heat. Now, taking the total heat of steam of atmospheric pressure to be 1146.6° F., one pound of carbon will evaporate $\left(\frac{13668}{1146{\cdot}6-212} = \right)$ 14·624 pounds of water from the temperature of 212° Fahr.

Let us now inquire what deduction from this absolute theoretic evaporation is inseparable from practice. In the first place, with the usual proportions of boilers, about twice as much atmospheric air passes through the furnaces as is required to furnish oxygen for the perfect combustion of the fuel; also, a large proportion of the air which is required to furnish even the exact quantity of oxygen for perfect combustion, is composed of nitrogen; hence, we have a large amount of useless atmospheric gases to be heated up, and a quantity of heat to be consequently lost, equal to the difference of their temperature on entering and leaving the boiler. The gaseous products of combustion also necessarily leave the boiler at an elevated temperature, in order to produce the draft; hence, another very considerable loss of heat. There is also a further practical loss by radiation. These losses, when the temperature of the smoke chimney is as low as about 350° Fahr., may be taken at about 30 per centum of the theoretic heat developed by the combustion, and with a higher temperature these losses will be proportionably greater.

First Experiment.—The first experiment deserving notice, is by Mr. Wicksteed, Engineer of the East London Water Works, Old Ford, England, with the Cornish boilers of that Company. The fuel was "small Newcastle coals of inferior quality." The data and results are as follows, viz:—

	Ordinary setting.	Baker's patent setting.
DATA.		
Duration of the experiment in hours,	207	108
Total pounds of coal consumed,	64940	31642
Pounds of coal consumed per hour,	313·7	293·0
Total pounds of clinkers and ashes made,	3895	2159
Pounds of clinkers and ashes made per hour,	18·8	20·0
Total pounds of coal consumed, after deducting clinkers and ashes,	61045	29483
Pounds of coal consumed per hour, after deducting clinkers and ashes,	294·9	273·0
Temperature of feed water in degrees Fahrenheit,	95½°	90°
Total pounds of water evaporated from temperature of feed water,	449320	243680
Pounds of water evaporated per hour from temperature of feed water,	2170	2256
RESULTS.		
Pounds of water evaporated from temperature of feed water, by one pound of coal, after deducting ashes and clinkers,	7·360	8.265
Pounds of water evaporated from temperature of 212° Fahr., by one pound of coal, after deducting ashes and clinkers,	8·277	9·344

From the above table it would appear that the result from the "Baker's Setting" was 12·9 per centum greater than from the "Ordinary Setting," taking the latter as unity; but as we are not informed whether the distance between the bottom of the boiler and the last bridge wall was the same in both cases, it is impossible to say whether this difference is owing to a better proportion of calorimeter or to Baker's curves.

The reader will be struck with the high absolute evaporation given in the above experiments, considering the type of boiler, and a little examination into it will be well bestowed. Now Richardson's ultimate analysis of Newcastle coal, after deducting clinkers, ashes, &c., gives the following composition, viz.

Oxygen,	8·57	per centum.
Hydrogen,	5·14	" "
Carbon,	86·29	" "
Total,	100·00	

Hence, the total absolute theoretical evaporation of this coal will be $(14{\cdot}624 \times 0{\cdot}8629 =)$ 12·619 pounds of water from temperature of 212° Fahr. per pounds of coal. Now the coal consumed in the above experiments after deducting for clinkers and ashes, contained $(8{\cdot}57 + 5{\cdot}14 =)$ 13·71 per centum of oxygen and hydrogen; hence the evaporation of 9·344 pounds of water per pound of coal with "Baker's Setting," will be increased to $\left(\frac{9{\cdot}344}{0{\cdot}8629} =\right)$ 10·829 pounds of water from temperature of 212° Fahr. by one pound of *carbon;* which allows a loss of only 14·2 per centum of the total theoretic evaporation, due to the draft, radiation, &c. The draft in these experiments was so sluggish, and the combustion consequently so slow, that when the doors of the furnaces were opened for firing, the smoke came out.

Second Experiment.

The second experiment deserving of attention, was made by Messrs. Borden, Parrott, and Nott, (composing a committee appointed by an Association of Civil Engineers of New England,) at the Linseed Oil Mill, East Boston, Massachusetts. The coal used was the red ash, Peach Mountain anthracite of Pennsylvania: the average weight of the lumps was 0·229 pound. The boiler was a plain cylinder. Each charge of coal was weighed whenever a new supply was needed, and the ashes, clinkers and unburnt coal were carefully weighed when removed. The water was evaporated under the pressure of 46 pounds per square inch above the atmosphere. With "Baker's Setting," five inverted arches were used, and the last bridge wall was 3½ inches below the bottom of the boiler: when this "setting" was changed to the "ordinary" one, it was effected by simply lowering the second bridge wall two bricks, and the third, fourth, fifth and sixth bridge walls three bricks, the latter being equal, including mortar joints, to a decrease in height of 8½ inches, making the total space between the bottom of the boiler and these latter bridge walls 12 inches.

From this description it is evident the results cannot be accepted as determining anything in favor of the "Baker's" over the "Ordinary Set-

ting;" for such a determination, it is indispensably necessary that the calorimeter, or distance between the boiler and bridge walls, should be the same; but here we see the calorimeter with the "Ordinary Setting" was nearly three and a half times greater than with the "Baker's Setting." The heated gases in both cases were passed over the furnace bridge wall through the same opening, but with the "Ordinary Setting" were allowed to immediately expand nearly three and a half times, thereby losing their temperature as a consequence of that expansion, and having a large proportion of their heat rendered latent. The results of these experiments then simply determine the relative economy of the two proportions of calorimeter, and no argument can be drawn from them in favor of the arches. The data and results of these experiments are as follows, viz.

	Baker's Patent Setting.	Ordinary Setting.
DATA.		
Duration of the experiment in hours,	48	48
Total pounds of coal consumed,	4362	4303
Pounds of coal consumed per hour,	90·87	89·64
Total pounds of clinkers made,	208	190
" " ashes "	341	332
" " partly burnt and unburnt coal fallen through grate bars,	232	354
Total pounds of coal consumed after deducting clinkers, ashes and unburnt coal,	3581	3427
Pounds of coal consumed per hour after deducting clinkers, ashes and unburnt coal,	74·60	71·39
Temperature in degrees Fahrenheit of the steam in boiler,	276°·90	278°·04
" " " " " feed water,	91°·15	89°·07
Total pounds of water evaporated from temperature of feed water,	31671	24157
Pounds of water evaporated per hour from temperature of feed water,	659·81	503·27
RESULTS.		
Pounds of water evaporated from temperature of feed water, by one pound of coal, after deducting clinkers, ashes and unburnt coal,	8·844	7·049
Pounds of water evaporated from temperature of 212° Fah. by one pound of coal, after deducting clinkers, ashes and unburnt coal,	9·945	7·976

From the above table it will appear, that the results from the *proportion of calorimeter* used with "Baker's Setting" was economically 24·7 per centum greater than with the *proportion of calorimeter* used with the "Ordinary Setting," taking the results by the "Ordinary Setting" as unity.

The composition of Pennsylvania anthracite, according to the ultimate analysis by Richardson, after deducting clinkers, ashes, &c., is as follows, viz.

Oxygen,	2·56	per centum.
Hydrogen,	2·55	" "
Carbon,	94·89	" "
Total,	100·00	

Hence the absolute total theoretic evaporation of this coal will be (14·624 × 0·9489=) 13·877 pounds of water from temperature of 212°

Fahr. per pound of coal. Now the coal consumed in the above experiments contained after deducting clinkers, ashes, &c., (2·56+2·55=) 5·11 per centum of oxygen and hydrogen; hence the evaporation of 9·945 pounds of water per pound of coal with the proportion of calorimeter used with "Baker's Setting," will be increased to $\left(\frac{9{\cdot}945}{0{\cdot}9489}=\right)10{\cdot}481$ pounds of water from temperature of 212° Fahr., by one pound of *carbon*, which allows a loss of 24·5 per centum of the total theoretic evaporation, due to draft, radiation, &c.

(To be Continued.)

For the Journal of the Franklin Institute.

Details of Construction of Steamers.

The *St. Louis*, is the name of the steamer in which the details are given in page 353, Vol. xxvii. She is now employed upon the route between New York and Havre *via* Southampton, in place of the Franklin, lately stranded upon the Coast of Long Island. Her load draft will be 14 feet 4 inches. Her fore and aft water wheel guards have been removed.

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*On the Fatigue and Consequent Fracture of Metals.**

At a recent meeting of the Institution of Civil Engineers, a paper was read on the above subject by Mr. F. Braithwaite, M. Inst. C. E.

Many accidents, the causes of which had been pronounced "mysterious," having professionally engaged the author's attention, he had carefully examined the circumstances of each, and the condition of the fractured metal, in all cases, and at length arrived at the conclusion, that almost all the accidents might be ascribed to a progressive deteriorating action, which might be termed the "Fatigue" of metals.

Metal in a state of rest, although sustaining a heavy pressure or strain, as in a beam or girder, and exhibiting only the deflexion due to the superposed weight, would continue to bear that pressure without fracture so long as its rest was not disturbed, and the same strain was not too frequently repeated; but if either of these cases occurred a certain disturbance of the particles took place, the metal was deteriorated, and that portion subject to the reiterated strain was so far destroyed, that it ultimately broke down. This might also arise from sudden concussions, when the metal was under a certain strain, and those concussions might be caused by the girder being suddenly unloaded.

Several examples were given of accidents of the kind that had been alluded to; for instance, that of a vat in a London brewery, carried on cast-iron girders, by which it had been supported for some years; but suddenly, without any apparent cause, they broke, and killed and wounded some workmen. In this case it was shown that the girders were not originally sufficiently strong for the load, and therefore the intermittent load of the vat, which was sometimes full and at other times only partially so, and then empty, caused a constantly recurring deflexion,

* From the Mechanics' Magazine, May, 1854.

and a subsequent corresponding effort to regain its natural position, by which the composition of the metal was disturbed, and fracture ensued.

Other examples of the same nature were given, and it was shown that the repeated buckling of the tube-plate of a locomotive, arising from the action of the pistons, had a tendency to cause fracture mechanically; and also that the side-strains and vibrations to which suspension-rods of the ash-pans of locomotives were subjected, had produced very serious results, which it sufficed to point out forcibly to guard against the recurrence of.

The author contended, that presuming adequate dimensions to have been given to girders, and the stipulated weight not to have been exceeded, the chances of accident were remote, but that any repeated deflexion, either at intervals, or continued for so long as to induce a permanent depression, must be productive of danger, which could only be averted by altering or replacing the parts deficient in strength, and maintaining a rigid supervision, whether of beams when loaded, or of parts of machinery, or of railway stock after working. By such means accidents would be prevented, and a greater degree of confidence be established in structures in which metal was employed.

For the Journal of the Franklin Institute.

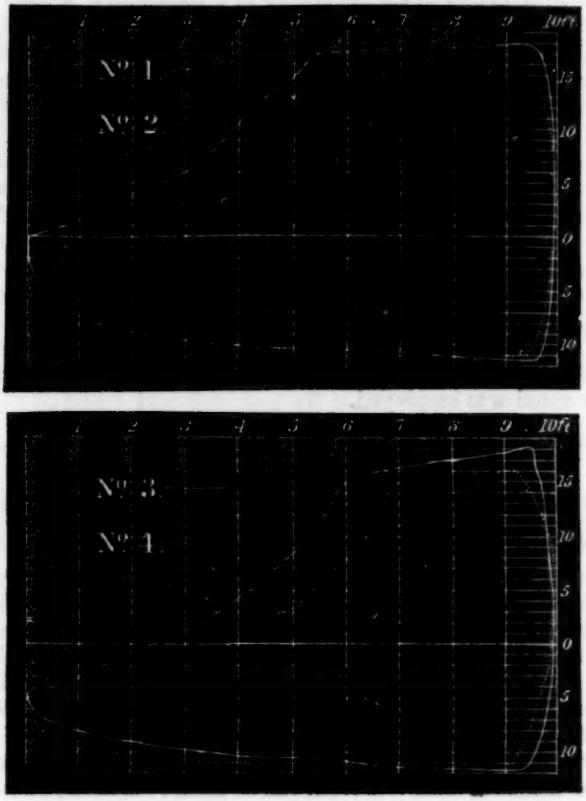
Abstract from the Steam Log of the "Baltic," Collins' Steamer, from Liverpool, July 8th, 1854. By Wm. H. Shock, Chief Eng. U. S. N.

To the kindness of Chief Engineer, R. Robinson, of the "*Baltic*," I am indebted for, (and by which I am enabled to lay before the readers of the *Journal*,) an abstract of the steam log of that ship, during her late and remarkably quick run from Liverpool to New York. It will be seen, that she left Liverpool on Thursday, June 29th, and arrived in New York, July 8th, having accomplished the run in the unprecedented time of *nine days, sixteen hours, and fifty-three minutes.*

The "*Baltic*" has just been furnished with two new cylinders, of the same dimensions as those removed, viz. 95 inches diameter, 10 feet stroke, and this was the first voyage made with them, as well as with the new composition tubes recently fitted in her boilers. I do not find any *marked* improvement in the efficiency of the boilers, resulting from the adoption of the composition tubes; as I find as good an average of steam given her, with about the same consumption of coal, on previous voyages; the cause of this I attribute entirely to the loss sustained by reflection, in consequence of the smooth and bright surface of the tubes, which a few trips will suffice to remedy.

The diagrams are the *originals*, taken during the voyage, and consequently have not been submitted to the possibility of an error, by copying. Nos. 1 and 2, were taken at 10 A. M., June 29th, (on the first day out from Liverpool,) steam by gauge 17½ lbs., revolutions 13·8 per minute. Nos. 3 and 4, were taken at 10 A. M., July 7th, (on the day previous to her arrival in New York,) steam per gauge 17½ lbs., revolutions 16·7 per minute. Nos. 1 and 3, were taken from the *bottoms* of port and starboard cylinders, respectively. Nos. 2 and 4, from the *tops* of port and starboard cylinders, in the same order.

No. 3 diagram, it will be observed, shows a slight excess of pressure in the cylinder over that indicated by the gauge, an error which I presume occurred in noting the pressure from the gauge. The same diagram



shows also a defective steam line, resulting, no doubt, from obstructions in the pipe, leading from the bottom of the cylinder to a point convenient for attaching the instrument near the top.

Abstract of Log of Steamship Baltic.

Month.	Day.	Date	Ave. Steam.	Ave. Rev.	Total rev.	Time.	Coal	Knots run.	Latitude.	Longitude.
1854			lbs.			Ho'rs.				
June,	Thursday,	29	16	13·1	18,935	23		294	55° 30′	9° 48′
"	Friday,	30	17½	13·9	20,468	24		318	55 05	19 08
July,	Saturday,	1	17½	14·4	21,172	24		326	53 45	28 03
"	Sunday,	2	18	14·9	22,056	24		325	52 44	36 40
"	Monday,	3	18	15·4	22,739	24		327	50 56	44 06
"	Tuesday,	4	17½	15·4	22,696	24		324	48 00	51 04
"	Wednesday	5	17⅞	16	23,381	24		322	45 20	58 00
"	Thursday,	6	17	16·3	24,007	24		319	42 50	63 45
"	Friday,	7	17½	16·6	24,412	24		332	40 45	70 40
"	Saturday,	8	16	16·4	13,220	13		160	miles to dock.	

Average coal, 95 tons per 24 hours.

Duration of passage, 9 days 16 hours and 53 minutes.

On the Results of a series of Experiments on the Decomposition of Water by the Galvanic Battery, with a view to obtain a constant and brilliant Lime Light. By the Rev. N. J. Callan, Prof. of Nat. Philos. in the Rom. Cath. Coll. Maynooth.*

Continued from p. 139.

Some of my experiments led me to believe, that, by means of the arrangement of the electrodes for a current of high intensity, the decomposing power of the battery may be considerably increased; from other experiments I was somewhat disposed to infer, that by such arrangement no increase of power can be gained. I am at present in doubt, and must remain so till the state of my health enables me to repeat my experiments.

The fluid which I first used in the voltameter was a solution of caustic potash. When a current was sent through the solution, the iron vessel was soon filled with foam, which came out through the jet with the mixed gas and extinguished the flame. I then tried a solution of carbonate of soda. The soda prevented the oxidation of the positive electrode as well as potash, and did not foam so much. However, even with soda, the quantity of foam was so great, that the iron voltameter, 16 inches high and 6 inches in diameter, would be very soon filled with it if a battery of more than about twelve 6-inch cells were employed. I tried various means of preventing the foam. I first covered the electrodes all round with a cloth, so that the gases should pass through it. Many of the bubbles were thus broken; but when a powerful battery was used, the voltameter was soon filled with foam. I then put about a teaspoonful of coal naphtha into the vessel. This prevented the foam from rising to any considerable height in the vessel, but it was somewhat injurious to the light. I also tried turpentine: it diminished the foam, but injured the light more than the naphtha. I think it increased the violence of the explosion of the gases. I afterwards tried some nitre, and also common salt; each of them prevented the foam, but destroyed the light. After failing in all my efforts to prevent the foam, I thought there was no alternative but to get an iron vessel so large that all the foam which could be produced by a powerful battery would be contained between the top of the electrodes or surface of the fluid, and the top of the vessel, without rushing through the jet. Latterly, I have tried carbonate of ammonia instead of soda, and have found that it foams much less, and that it prevents the action of the oxygen on the positive electrode. A solution of the proper strength will be obtained by dissolving an ounce and a quarter, or an ounce of the carbonate of potash, soda, or ammonia in a quart of water. If there be more than an ounce and a quarter to each quart of water, the quantity of foam will be very considerable; if there be less than an ounce, the conducting power of the solution will not be sufficient, and the quantity of the gases produced will be greatly diminished.

For either of the two arrangements of the electrodes I have described, a cylindrical vessel does not answer well. For them a prismatic vessel having a rectangular bottom is the most convenient. The inside of the

* From the Lond., Edin., and Dub. Philos. Mag., Feb., 1854.

iron vessel should be coated with an alloy of lead and tin, or of lead, tin and antimony, in which the proportion of tin, or of tin and antimony, is small,—first, in order to preserve it from rust; secondly, to protect it against the action of sulphuric acid, and thus render it fit for a voltameter, in which the positive electrode is platina; the negative one, tin plates coated with an alloy of lead and tin; and the fluid through which the voltaic current passes is dilute sulphuric acid. The coated sides of the vessel may be the negative electrode. With an iron voltameter such as I have described, the mixed gases may, without the slightest danger, be inflamed as they are produced by the decomposition of water, and a constant and brilliant lime light may be obtained.

The third result is a new negative element, cheaper, more durable, and one which may be made to act with greater power than the platinized silver used in Smee's battery. It is sheet tin, coated with an alloy of lead and tin, in which the proportion of tin is not greater than that of lead, or of lead, tin, and a small quantity of antimony. On tin plates thus coated, the dilute sulphuric acid commonly used in Smee's battery will scarcely exert any action. It may be platinized like sheet silver; or it may be coated with borax, and will then answer as well, or very nearly as well, as if it were platinized. It is evident that tin plates thus prepared are far cheaper and more durable than platinized silver; and because they can be brought nearer than platinized silver to the zinc plates without danger of touching them, they may be made to act with greater power.

The fourth result is a new means of protecting iron against the action of the weather and of various corroding substances, so that iron thus protected will answer for all the purposes to which sheet lead and galvanized iron are applied. Besides the experiments by which I have proved the superiority of tin plates (that is, of sheet-iron plates), coated with an alloy of lead and tin, over leaden ones, as the electrodes of a voltameter, I have made many others, in order to compare the action of concentrated nitric, sulphuric and muriatic acid, as well as of dilute sulphuric and muriatic acid on lead and galvanized iron, with their action on iron coated with an alloy of lead and tin, in which the quantity of lead was about equal to that of tin, or from two to seven or eight times as great as that of tin; and from these experiments I infer that iron, coated with any of the above-mentioned alloys, is less oxidable and less liable to corrosion than lead or galvanized iron, the zinc coating of which, as every one knows, is rapidly dissolved by the acids, even when they are greatly diluted with water. Iron, then, coated with an alloy of lead and tin, in which the quantity of lead is nearly equal to, or exceeds that of tin, will answer as well as lead or galvanized iron for roofing, cisterns, baths, pipes, gutters, window-frames, telegraphic wires, for marine and various other purposes. A small quantity of zinc, mixed with the alloy with which the iron is coated, hardens the coating, but diminishes its power of resisting corrosion. But the addition of a little antimony not only hardens the coating, but also makes it less oxidable and less liable to corrosive action. Iron, coated with the alloy of lead and tin, or of lead, tin and antimony, may answer better than lead for vitriol chambers. It may be sometimes used instead of copper for the sheathing of ships;

and bolts and nails of coated iron may be sometimes employed instead of copper bolts and nails. It may also be used for some of the purposes for which enamelled iron or cast iron is employed, such as the enamelled cast iron cisterns and pipes used in water closets. At the last meeting of the British Association at Hull, Dr. Gladstone stated, that the owners of iron built ships object to sugar cargoes, because the saccharine juices that exude from the casks corrode the metal. If the casks or the ships were lined with thin sheet iron, coated with an alloy of lead and tin, containing two or three times as much lead as tin, it is highly probable that the corrosion of the ships would be prevented. I have left for a considerable time a small piece of an alloy of lead and tin, in which the quantity of lead was four or five times as great as that of tin, in a solution of sugar and common water; and the alloy came out as bright as when it was put into the solution.

The fifth result is a new mode of producing, by means of a small galvanic battery, a brilliant intermittent lime light. By means of a battery of twelve 4-inch cast iron cells, or of four cells each 6 inches by 8, a small voltameter, such as I have described, and a good Hemming's jet, a constant lime light, about a quarter of an inch in diameter, may be produced. If then the jet be attached to a stop-cock, by which the gases are confined in the iron voltameter for fifty-five seconds in each minute, and are allowed to issue from the jet only for five seconds in each minute, twelve times as much of the gases must pass through the jet in these five seconds as would pass through it in the same time were the stop-cock always open. Hence if the gases produced by the battery are ignited for five seconds in each minute as they issue from the jet, and are confined in the voltameter for the remaining fifty-five seconds, the flame will, when thrown on lime, give a light twelve times as large as one a quarter of an inch in diameter, or nearly seven-eighths of an inch in diameter. If the breadth of the hole in the key of the stop-cock be $\frac{1}{24}$th of the circumference of the key, and if the key make a revolution in every two minutes, the stop-cock, because it is opened twice in each complete revolution of the key, will be opened once in every minute for five seconds, and will be closed for fifty-five seconds. Now, by clock-work, it is very easy to make the key of the stop-cock perform a revolution once in every two minutes, and consequently to produce a lime light seven-eighths of an inch in diameter for five seconds in every minute. It is easy to make the motion of the key and the ratio of the diameter of the hole to the circumference of the key such that the stop-cock will be opened once in two minutes for ten seconds, and will be closed for a minute and fifty seconds. In order to light the gases whenever the stop-cock is opened, it is necessary to have a small flame of gas or of a candle always at the nozzle of the jet. A lime light of seven-eighths of an inch in diameter would be seen at a far greater distance, particularly in foggy weather and in snow-storms, than the light of a lamp; and is therefore of the utmost importance in light-houses. Had there been such a light in the Bayley Light-house, the *Victoria* would in all probability not have been lost. The expense or trouble of such a light would not be very great, and would be amply compensated by saving the lives of many every year. The light might be used only in foggy weather or in snow-

storms, when a light capable of penetrating through a dense atmosphere or a shower of snow would be required. On other occasions the ordinary lights might be employed. The expense of an intermittent lime light, such as I have described, would be the cost of working a cast iron battery, containing four zinc plates, each 6 inches by 8, for sixteen or seventeen hours a day, and of a very minute flame of common coal-gas for the same space of time, as often as the light might be required. Surely such an expense could not be very great. Should it be apprehended that the action of the battery would not be sufficiently constant to give the light required, then three large gas bags, each of which would contain as much of the mixed gases as would be sufficient to maintain a lime light three-fourths or seven-eighths of an inch in diameter for half an hour, might be filled during the day with the mixed gases by two or three small batteries. Then, by means of the apparatus which I have devised for safely applying the mixed gases to the production of intense heat and light, of a proper jet, a suitable adjustment of clock-work, and a very small flame of coal-gas, the intermittent light may be kept up for eighteen hours; for the light would last only five seconds in each minute, and consequently only five minutes in each hour, or an hour and a half in eighteen hours. Therefore, since the three gas bags, filled with the mixed gases, would maintain a constant light for an hour and a half, they should keep up the intermittent light for eighteen hours. I believe such an intermittent would answer very well for light-houses. In the light-house on the eastern pier at Kingstown, the light is a revolving one, which completes a revolution in about a minute. The brilliant white light, the only one which can be seen at a distance, shines out only for about five seconds in each minute. Hence I infer, that an intermittent lime light which lasts for five seconds in each minute would be sufficient for light-house purposes. It is necessary to observe, that, when gases are gradually cut off from the jet, the gases in the upper part of the voltameter, or vessel to which the jet is attached, will explode if a Hemming's jet be not used; and this explosion, though perfectly free from danger, will be attended with inconvenience, for a vacuum will be produced in the upper part of the voltameter or vessel, and no gases can pass to the jet till this vacuum is filled. Hence, in producing an intermittent lime light, a Hemming's jet should be employed. Since the discovery of the cast iron battery, several persons have obtained patents for apparatuses for the coke light, or, as it is now called, the electric light. If they arranged their apparatus so as to produce an intermittent coke light similar to the intermittent lime light I have described, they would confer a great benefit on society. When the coke light is constant, the battery is soon exhausted, the coke points are consumed, and must be frequently renewed; but were the light intermittent, a single charge of the battery might last for an entire night, and it would be sufficient to renew the coke points two or three times in the course of the night. And if an intermittent coke light were used in light-houses only on very dark and foggy nights and in snow-storms, the expense could not be considerable. I think the coke light is more intense than the lime light, and also somewhat less expensive. To produce a coke light sufficient for all illuminating purposes, forty cast iron cells, each containing a zinc plate 2 inches by 4,

will suffice. To obtain a lime light of equal illuminating power, a battery containing at least twice as large a surface of zinc will be required. A battery with a given charge will scarcely work twice as long in decomposing water as in igniting a pair of coke points. Therefore, on the whole, I think the lime light is more expensive, but much more easily managed than the coke light. The former requires a battery of only four large plates; the latter depends on the intensity of the current, and requires a battery of at least thirty-five or forty cells. The coke points will require to be changed more frequently than the lime; and there is more reason to fear that the coke light will fail on account of the destruction of the positive coke point, than that the lime light will go out on account of the wearing of the lime. For the coke light, the zinc plates should not contain more than 8 square inches of surface. If they be larger, the positive coke point will be rapidly destroyed, without a proportional increase of light.

The sixth result is a new mode of exhibiting the dissolving views by means of the lime light. In the common apparatus for showing the dissolving views, the apertures of the lanterns are gradually opened and gradually closed, in order to make the figures come gradually into view and gradually disappear. By using the mixed gases, the apertures may be left always open, and the figure in either lantern may be gradually brought out on the screen, and may be made to fade away by degrees; for by opening very slowly the stop-cock through which the gases pass to the jet, the light in the lanterns may be made to increase very slowly till it has acquired its full intensity, and consequently the image thrown on the screen will become gradually brighter till it attains its full brightness; and by very slowly closing the stop-cock, the light, and consequently the image, will gradually fade away. By exhibiting the dissolving views in this way, there is a great saving of the mixed gases; for the light shines out fully in each lantern only when it is necessary to exhibit the image in full brightness on the screen. Besides, by diminishing the quantity of the gases which passes through one jet, the quantity which passes through the other jet, and consequently the brightness of the full image, is increased.

The last result is a new sine galvanometer, which is the only instrument yet devised for measuring with accuracy very powerful galvanic currents.* Some of my experiments raised doubts in my mind about some of the generally received theories relating to the action of the galvanic battery. The galvanometers which I had were not fit for measuring very powerful currents, such as I employed. I was therefore obliged to get a new one. After a good deal of reflection, I resolved to get one which would answer for a sine instrument, for the common tangent instrument, and for the new tangent galvanometer, the principle of which is demonstrated in the *Comptes Rendus* of the 24th of last January. The galvanometer which I have made consists of a mahogany circle, 2 feet 4 inches in diameter, and nearly 2 inches thick, in the circumference of which is turned a groove half an inch wide and $3\frac{1}{2}$ inches deep; of seven concentric coils of $\frac{3}{8}$ inch copper wire in the groove, and well insulated

* The voltameter will not measure powerful currents produced by a single circle, or by two or three circles.

from each other; of a strong frame in which the circle is movable on an axis, and always kept in a vertical position; and of a compass-box, which, by means of a slide 3 feet long and at right angles to the circle at its centre, may be moved in a direction perpendicular to the circle to the distance of 3 feet from it, so that the centre of the needle, which is a bar needle $5\frac{1}{8}$ inches long, will always be in the axis of the circle and of the coil, and that the line joining the north and south points of the compass-box will be always parallel to the horizontal diameter of the mahogany circle and coil. From this description of the instrument, it is evident that (no matter where the compass-box is placed on the slide) the needle is parallel to the mahogany circle and coil, or perpendicular to their axis, whenever it points to 0°. Hence, if a voltaic current, sent through the coil, deflect the needle, and if the circle and coil be turned round so as to follow the needle until it points to 0°, the needle, no matter where it may be placed on the slide, will then be parallel to the coil and perpendicular to its axis. The magnetic power of the coil is exerted in the direction of its axis. The effective part of the earth's magnetism in impelling the needle to the magnetic meridian is also exerted in the direction of a perpendicular to the needle or of the axis of the coil, but opposite to that in which the magnetic force of the coil acts. Since the needle is kept at rest by these two forces acting in opposite directions, they must be equal. But the effective part of the earth's magnetism in impelling the needle to the magnetic meridian, varies as the sine of the angle which it makes with that meridian. Therefore the magnetic power of the current flowing through the coil also varies as the sine of the angle which the needle, when it points to 0°, or the mahogany circle D, makes with the magnetic meridian. If the connexion with the battery be broken, the needle will immediately return to the magnetic meridian. The graduated circle of the compass-box will give the number of degrees the needle was deflected from the magnetic meridian. For measuring the angle of deviation, I have used a large graduated circle about 13 inches in diameter, which is attached to the upper part of the mahogany circle, and at right angles to it and to the axis about which it is movable. By means of seven brass bolts, each three-eighths of an inch in diameter, I can send the current from the battery through one coil, or seven, or through any intermediate number of coils. I scarcely ever use more than one coil, and that is the outside one, the diameter of which is about 2 feet 2 inches. When the current is sent through seven coils, the deflexion is so great that only very feeble currents can be measured on the sine galvanometer. When the needle is in the centre of the coil, this galvanometer, used as a sine instrument, large as its diameter, is not capable of measuring the power of a current produced by a single circle of the cast iron battery, in which the zinc plate is an inch broad and 4 inches long. The coil, when made to follow the needle, drives it always before it, so that the needle will never remain parallel to the coil. Hence, in Pouillet's sine galvanometer, in which the centre of the needle is in the centre of the coil, only feeble galvanic currents can be measured. But by sliding the compass-box and needle to 2 or 3 feet from the coil, a current of very great power may be measured. A current which produces a deflexion of 75° when the needle is in the centre of the coil, will

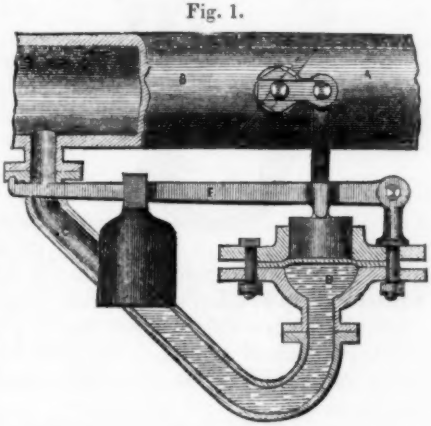
produce a deflexion of only 3° when the needle is at a distance of 3 feet from the coil and its centre in the axis of the coil. Hence, by our galvanometer, in which, and in which alone, the needle may be moved to a distance from the mahogany circle or coil whilst its centre is in the axis of the coil, currents of enormous power may be measured. With this galvanometer I expect to determine,—first, the smallest number of circles, the currents of which will be fully effective, or at least as effective as any larger number of galvanic circles in decomposing water, and consequently the number which may be used with the greatest advantage in decomposition; secondly, whether Mr. Faraday's law, viz. that the quantity of the mixed gases produced by a voltaic current is proportional to the quantity of electricity which passes, holds for currents of great power; thirdly, the proportion which the surface of the decomposing plates should bear to the acting surface of zinc in each circle; fourthly, whether a battery with a given charge will work longer in producing the lime light by decomposing water than in producing the coke light, and which of the two lights is the more economical.

(To be Continued.)

Description of Apparatus for Regulating Steam Pressure. By M. Gray.*

The great advantage to manufacturers and the employers of steam machinery—derivable from a simple means of obtaining invariable or uniform low pressure steam from a single source of variable or irregular pressure—have led me to adopt the apparatus represented in the two sketches annexed. Both arrangements are obvious modifications of the well known regulators patented and made by Mr. David Auld, who is now introducing the new forms for various manufacturing purposes, as being free from the defects of the steam piston plans, which are liable to stick, or to pass steam. In fig. 1, A B is the main steam pipe, conveying the initial high pressure steam from the boiler to the scene of operation of the lower pressure, the current being in the direction from A to B. From the side, B, a small branch pipe, C, passes downwards, and opens up, by a quick bend, into the lower side of an elastic diaphragm chamber, D. And to prevent the steam itself from coming in contact with the diaphragm, water is allowed to collect in this pipe, to form the actual means of communication with the chamber. This chamber is a simple cup, having a disk of vulcanized india rubber stretched across it, and held down by the

Fig. 1.



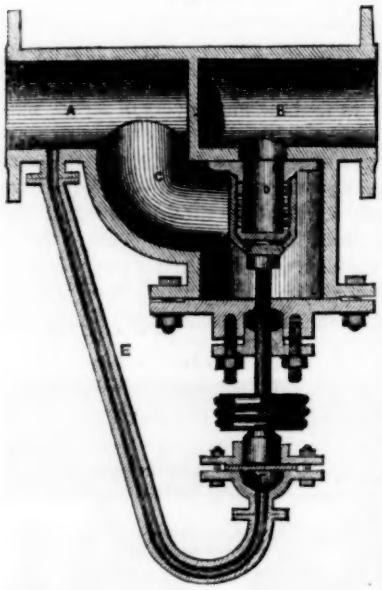
* From the London Practical Mechanics' Journal, April, 1854.

flanch of an upper bored cap, answering as a guide for a short plunger. The bottom of the plunger rests upon the elastic diaphragm, and a link passes up from it to the crank arm of a common throttle valve, forming the separation between the two parts, A B, of the main steam pipe above. The plunger is also additionally loaded by a lever, E, with an adjustable weight upon it.

To those who have given any attention to similar matters, the action of the arrangement must be pretty obvious. The steam from the side, B, of the main pipe, presses upon the under side of the elastic diaphragm, and thus closes more or less the throttle valve in the main pipe. This reduces the steam flow from the side, A; and by shifting the weight back or forward on the lever, E, the attendant can at once obtain any pressure less than that in the boiler, as he may require it. The further the weight is set towards the end of the lever, the less will the throttle valve be closed, and consequently the higher will be the pressure of the steam flowing off at B.

Fig. 2 is a similar sectional view of another modification, wherein an equilibrium valve is used instead of a common throttle valve. The two sections or chambers, A B, form part of the line of main pipe. From the section, A, a wide pipe, C, opens into the chest of the balance valve, D, which is worked from below, and opens into the section, B. A second and narrow pipe, E, also opens from the side, A, in an elastic diaphragm chamber, F, fitted with a plunger, as in the former arrangement. The spindle of this plunger carries a series of adjustable weights, and it extends upwards and enters the balance valve chamber by a bottom stuffing box, the entered end of the spindle being attached to the sliding cup of the valve. The high pressure steam enters the section, B, of the main pipe, and passes through the balance valve to the branch, C, and thence to the section, A, from which it finds its way to its place of use. The branch pipe, E, from the reduced pressure side, as in the former example, affords the necessary means of regulation, adjustable by means of the movable weights on the plunger spindle.

Fig. 2.



This system of regulation has been some time in successful operation at the cotton mill of Messrs. James Black & Co., Peel Street, Mile-End, Glasgow.

Glasgow, March, 1854.

For the Journal of the Franklin Institute.

Particulars of the Steamer Indiana.

Hull built by C. J. Mare & Co., London. Machinery by Maudslay, Son & Field, London. Intended service, East Indies.

HULL.—

Length on deck, from fore part of figure head, to after part of stern post above the spar deck,	270 feet	3 inches.
Length on deck, from taffrail to stern,	253 "	7 "
" "	210 "	3 "
Breadth of beam at midship section,	38 "	4 "
Depth of hold,	27 "	10 "
" " to main deck,	20 "	4 "
Draft of water at load line,	17 "	4 "
" " below pressure and revolutions,	15 "	6 "
Tonnage,	2500.	
Masts and rig—	Barque.	

ENGINES—Inclined athwartwise—

Diameter of cylinder,		55 inches.
Length of stroke,	2 feet	6 "
Maximum pressure of steam in pounds,	12.	
Maximum revolutions per minute,	50.	

BOILERS—Four—tubular.

Description of coal,	Bituminous.
Draft,	Natural.
Consumption of coal per hour,	2800 pounds.

PROPELLER—of Maudslay's patent—connected direct to engine—

Diameter of screw,	15 feet.	
Pitch of "	21 "	
Number of blades,	2.	

Remarks.—Frame of wrought-iron ⌐ Z, 4 and $5\frac{1}{2} \times \frac{3}{8}$ inch. Floor timbers *molded* $5\frac{1}{2}$ inches. *Sided* $\frac{3}{8}$ inch. Distance of frames apart *at centres*, 14 and 22 inches. Thickness of plates, $\frac{7}{8}$ $\frac{3}{4}$ and $\frac{5}{8}$ths. One air pump in common. Clincher built and single riveted. Frames are alternately single and double, as above shaped, and are connected athwartwise by an iron plate 16 inches deep at the keelson centre line.

Translated for the Journal of the Franklin Institute.

Changes of Length in Bars under the Influence of their own Weight.

M. J. T. Silbermann has endeavored to measure the elongation by its own weight of a bar suspended freely, and the shortening which it undergoes from the same cause, when resting vertically upon its base. Although these changes are very small, yet they may not be altogether negligable in very accurate determinations.

For the purpose of measuring these variations, M. S. made use of a system of two coupled rules, the one of platina, the other of bronze, form-

ing together a Borda thermometer. The following is briefly the description:

The platina rule covers that of bronze, and is attached to it, near one of its extremities, by a screw with conical centre, which traverses both. At 965 millimetres (38·00556 inches,) from the centre of this screw is the zero line of the vernier screwed on to the side of the bronze rule; this vernier corresponds to a division traced on the flat surface of the platina rule, and gives the variations of length in hundredths of a millimetre, and also, permits by means of a lens, to estimate the thousandths. A vernier and division are placed opposite to the centre of the screw for the assurance of its invariability. The two small rules of platina on which these two verniers are cut, serve as a guide to one side of the rules to prevent their lateral deviations; in the same way, there was fixed on the bronze rule and opposite the verniers, a small bronze rule, which like them, touched the upper surface of the platina rule and assisted in guiding the two rules, without, however, compressing them or preventing them from elongating or contracting independently of each other.

These two rules, of nearly the same length and weight, were submitted to two different modes of experimenting. In the first mode, the two rules were suspended vertically and freely by their upper part, the conical centre which united them, being above, and near the point of suspension. The mean of the vernier readings was —0·01833 mm. In the second mode, the two rules were turned upside down, and rested vertically upon the same end, now the lower; the mean of the vernier was +0·01833 mm. These means represent only the difference of the effect on the two rules. To get the absolute effect for each, it was necessary to use a new vertical position, partaking of the other two. In this, the conical centre was above, as in the first position, but in place of suspending the system, the bronze rule was alone supported on its base, while that of platina remained suspended from it by the screw, and, consequently, remained invariable in these two positions, while the bronze, which was now compressed, both by its own weight and by that of the platina, was formerly stretched by its own weight alone: the mean of the readings gave —0·00833 mm.

Taking into account the weights and opposite actions in the first and fourth experiments on the bronze rule, we get the absolute movement of this rule, 0·00329 mm.; adding this value to the observed difference + 0·01833 mm. we get + 0·2275 for the absolute change of the platina rule. As these values refer to the length, 965 mm. we shall get, by reduction to the standard, for the elongation or shortening of rules one metre long by their own weight. For bronze + 0·00341 millimetres,

Platina + 0·02305 "

Thus according as graduated scales are suspended, as in barometers, where they are moreover elongated by the weight of the glass and mercury, or in cathetometers, where they are either elongated or shortened according to the construction, we have corrections to introduce into the results. This is, above all, necessary, in the delicate measurements of the simple pendulum.

It will be observed, that the zero or vertical point, that is, the length

when not under the influence of the weight, is the exact mean between the positions of lengthening and shortening in the first and second experiments. M. S. was curious to know, whether if the rules left one or the other of these contrary positions, the vernier would come to 0, when they were laid horizontally. This was tried in the following way: the rules suspended at first, vertically, along a carefully adjusted plank were afterwards supported on a foot at the bottom; after each of these modifications, the plank was inclined gently until it with the rules took the horizontal position. The following results were obtained, after elongation the horizontal reading gave the mean —0·00376 mm. after shortening +0·00766 mm. Thus the two rules remained lengthened after the experiment of elongation, and shortened, after the experiment of compression, and in the latter case, the difference was considerable.—*L'Institut*, Vol. xxii, p. 168. *Acad. des Sciences de Paris*, 15th May, 1854.

Translated for the Journal of the Franklin Institute.

Process for Heliographic Engraving.

M. Baldus takes simply a plate of copper, and spreads upon it a sensitive coating of *bitumen of Judea*. Upon this plate, thus covered, he lays a photograph on paper of the object to be engraved. This photograph is positive, and must consequently, impress a negative on the metal by the action of the light. After about a quarter of an hour's exposure to the sun, the image is produced upon the resinous coating, but is not visible, and it is made to appear by washing the plate with a solvent, which removes the parts not affected by the light, and allows the picture to be seen represented by the resinous lines of the bitumen. The design, however, is formed by a veil so delicate and thin, that it would soon partly disappear if the plate remains in the liquid. To give it the proper firmness and resistance, it is exposed for two days to the action of diffused light; the picture being thus strengthened by its exposure to day light, the plate is plunged into a galvano-plastic bath of sulphate of copper. If, then, you attach the plate to the negative pole of the battery, you deposit on the unprotected parts of the metal, a coating of copper in relief; but if you attach it to the positive pole, you eat away the metal at these points, and thus form an engraving, so that you can, at will, according to the battery pole which you use, obtain either an engraving analogous to an ordinary copper-plate, which can be printed by the same process, or an engraving in relief, to be printed like a wood cut, with printing ink.

When it is desired to reproduce an ordinary engraving, clearly executed upon paper, as in the case assumed above, the photograph requires no peculiar preparation previous to its transfer to the metal. But this is not generally the object of photographic engraving; it is to reproduce natural objects without any intermediate process. When, then, it is required to reproduce, for instance, objects of natural history, landscapes, or monuments, the photograph used must be got in a way somewhat differing from the common mode. It is, in fact, the production of that which

engravers call the grain, that is, the lights, put by the graver in the shadows of the picture, which constitutes the essential difficulty in engraving photographs. The photograph has nothing of the kind, for the shadows are made of an uniform tint; we require, therefore, a peculiar artifice to produce this grain which does not exist in the photograph. In the works of MM. Rousseau, Dévéria, and Riffaut, they are produced afterwards on the plate by the graver. In the new process, proposed by M. Baldus, this grain, so necessary for the engraving, is formed on the photograph itself, and the use of the graver thus rendered superfluous. This grain is formed on the negative photograph, by adding to the sensitive substances, a compound which crystallizing in the paper, forms small transparent grains. The complete publication of all the details of this new process, which the author will doubtless make, will allow the curious chemical effect which takes place under these circumstances, to be understood.

There remains but a single word to be added; the proofs on paper obtained from these new plates of photographic origin, are so perfect that the great problem of engraving by the agency of light may be regarded as definitely solved. Not only this new process is going to reduce very much the price of engravings, but there is no artist or amateur of photography, who may not soon have the pleasure of reproducing, in a corner of his room, all the photographs which he obtains.

Cosmos, 26th May, 1854, p. 615.

Translated for the Journal of the Franklin Institute.

New Process for Procuring Phosphorus. By M. Cari-Montrand.

M. Dumas read to the Academy of Sciences, at Paris, at their Session of 15th May, a letter from a young chemist, M. Cari-Montrand, in which he proposes a new mode for the preparation of phosphorus on a practical scale, the usual process being slow, complicated, yielding but little product, and giving an educt of no value. The process proposed, consists of passing over a thorough mixture of equal parts of finely powdered charcoal and bone-earth, at a red heat, a quantity of dry hydro-chloric acid, or still better, of dry chlorine. The end of the porcelain tube in which the experiment was performed, was attached to a glass tube dipping under water. Phosphorus, carbonic oxide, and water, are given off, and chloride of calcium is left in the tube. On analysis, no trace of phosphoric acid, or any other compound, was found in the tube; the decomposition is therefore complete, and as no phosphorus passed off, the whole amount contained in the earth was obtained as a product. The following equation explains the reaction, when hydro-chloric acid is used:

$$3\,Ca.O,\,PO_5 + 5\,C + 3\,H\,Cl. = 5\,CO + 3\,HO + 3\,Ca.\,Cl. + P.$$

The same letter contains a notice interesting to chemists, of the entire decomposition of gypsum, and the procuring of its sulphuric acid, by

treatment of a mixture with charcoal by dry chlorine, or hydro-chloric acid gas. A good deal of excitement appears to have been caused among some of the would-be scientific papers, by the announcement of this process, which, it was asserted, would materially reduce the price of sulphuric acid. But it will be easily seen that, as at least the equivalent of hydro-chloric acid (dry weight 36) must be used for each equivalent of oil of vitriol, (weight 49,) the process would be more expensive than at present. This is clearly stated by M. Cari-Montrand, who had the process tried on a large scale by M. Kühlmann, but found that the expense of making and drying the hydro-chloric acid, was an insurmountable obstacle to its introduction into the arts.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, August 17, 1854.

J. Vaughan Merrick, President, pro tem., in the chair.

Isaac B. Garrigues, Recording Secretary.

The minutes of the last meeting were read and approved.

A letter was read from the Royal Society of London.

Donations to the Library were received from the Geological Society, and the Statistical Society of London. Hon. James Meachum, U. S. Congress; Prof. A. D. Bache, U. S. Coast Survey. The Kentucky Mechanics Institute, at Louisville Ky., Dr. J. Aitken Meigs, and Messrs. Lindsay and Blakiston, Philadelphia.

The periodicals received in exchange for the Journal of the Institute were laid on the table.

The Treasurer's statement of the receipts and payments for August, was read and approved.

The Board of Managers and Standing Committees reported their minutes.

New candidates for membership in the Institute (3) were proposed, and the candidates (4) proposed at the last meeting, were duly elected.

Dr. Rand, Chairman of the Committee on Meetings, exhibited a model of Mr. Truman's sewer trap. The throat of the sewer is closed by a bed plate pierced with an oblong opening, beneath which hangs a plate so counterpoised, as always to press against and close the opening. This plate or valve opens in proportion to the amount of liquid poured into the mouth of the sewer. There is also a pipe communicating above the surface, which is closed by the plate which shuts off the main opening, and is opened when it is depressed. This is intended to allow of the exit of compressed air, &c.

Also, a model of an apparatus for keeping boilers free from scale, invented by Mr. J. McMullen, of Baltimore, Md. A rod with a crank attached, passes through the head of the boiler having radial arms attached to it, and connected by rods passing longitudinally. These are covered with wire,